

Bone regrafting after unsatisfactory mandibular reconstruction.

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Abstract : Reconstruction of the mandible was performed through bone grafting following mandibular resection in five patients with extensive ameloblastoma. Because of unsatisfactory results due to infection, fracture of the graft and pseudoarthrosis formation, reconstructions were attempted employing a graft from a rib, ilium or the lower border of the mandible. As a result, the contour and function of the mandible improved and dentures were successfully applied over a period of 2 or 3 years. In this paper, the causes and procedures of the unsatisfactory results following mandibular reconstruction are discussed.

Mandibular reconstruction following resection of benign tumors is not always successful. Postoperative unsatisfactory results are occasionally encountered. However, ultimately, successful results should be achieved through proper procedures.

During the 12-year period between 1965 and 1976, we performed mandibular reconstructions in 38 patients at Iwate Medical University, School of Dentistry¹⁾. Recent follow-up studies on 28 of these patients with benign tumors revealed unsatisfactory postoperative results such as two infections, two fractures of the graft and one formation of pseudoarthrosis which occurred in five cases, so that regrafting with rib, ilium or a piece

of the lower border of the mandible was performed respectively. In view of the favorable results in these patients, the causes and procedures of these unsatisfactory results following mandibular reconstruction, were studied.

There were three males and two females, ranging in age between 39 and 62 years, who were treated during the 3 year period between 1975 and 1977. All these patients had extensive invasion of ameloblastoma in the mandible (Fig. 1).

Two Cases of Postoperative Infection

In Cases 1 and 2, diffuse swelling was noted in the cheek, with a bony elevation of the gingiva of the posterior teeth. The x-ray findings revealed mul-

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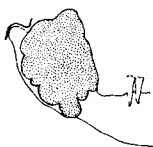
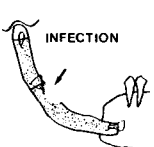





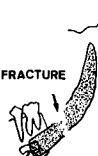

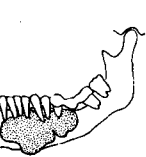
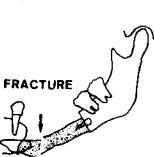
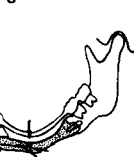

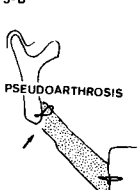
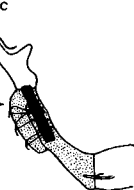
Patients Sex Age	Location of tumors	Bone grafts and unsatisfactory findings	Bone regrafts
Case 1 M 59	1-A 	1-B INFECTION 	1-C 
Case 2 F 39	2-A 	2-B INFECTION 	2-C 
Case 3 F 49	3-A 	3-B FRACTURE 	3-C 
Case 4 M 62	4-A 	4-B FRACTURE 	4-C 
Case 5 M 54	5-A 	5-B PSEUDOARTHROSIS 	5-C 

Fig. 1—Schemes of panoramic radiograph at the time of bone regrafting. Each arrow shows absorption of bone graft in 1-B—5-B and location of bone regrafting in 1-C—5-C.

tilocular bone resorption from the premolar region to the mandibular ramus (Fig. 1. 1-A, 2-A).

Under general anesthesia with GOF, the tumor was dissected together with the periosteum invaded through the intraoral and extraoral approach. In Case 1, a discontinuous resection of the mandible was performed from the region of the right lower first premolar to a point 0.5 cm from the condyle. Following this, a 13 cm piece of bone was removed from the left and right iliac crests for bridge bone grafting. In Case 2, a discontinuous resection of the mandible was performed from the left lower second premolar region to the basal portion of the left condylar process of the mandible.

For bridge bone grafting, a 9 cm piece of bone was removed from the right iliac crest. In both patients, the ends of the host bone and graft were sutured with No. 18.8 steel wires, and all voids and points of bony approximation were well packed with an abundance of cancellous hematopoietic bone. Before bone grafting, previously prepared acrylic splint attached to the remaining maxillary and mandibular teeth was used for maxillo-mandibular fixation with the teeth of continuous ligature. After grafting, tight sutures were placed over the muscle layers and skin.

In both of the patients, however, the angle of the mandible showed reddening and swelling from around the second week after the operation, with a fever from 37 to 38°C and the retention of exsudate. The results of cultures, however, were negative. Despite the administration of prophylactic antibiotics, streptococci were

detected around the 4th week, indicating a secondary infection.

Moreover, around 3 months after the operation, the x-ray pictures revealed bone resorption in the mandible (Fig. 1. 1-B, 2-B). Since sequestrums were noted on curettement of this portion of the bone grafts, in one patient 2/3 and in the other 1/2 of the central part of the graft was removed of the three months respectively.

In two patients, 8 and 7 cm of bone were taken from the 7th rib for regrafting on 8th and 12th month after immediate mandibular reconstruction. Six to ten drill holes were made in the piece of rib and the surrounding soft tissue of the graft was tightly applied to these holes and sutured in place with catguts to prevent dead space and hematoma (Fig. 1. 1-C, 2-C).

Approximately 6 months after regrafting, the x-ray picture revealed radiopacity at the junction of the graft and the host bone, indicating an almost complete bony union. Also about this time, the drill holes in the graft gradually disappeared, supporting the presumption that the bone graft remodelling was satisfactory.

In both of these patients, the postanterior x-ray findings revealed a displacement to the medial side of the condylar process (Fig. 2, 3). A mild depression was seen in the region of the mandibular angle of the affected side, with a slightly more pronounced change in Case 1, but the patient was satisfied with the results because of his advanced age. At the maximum opening of the mouth, the mandible deviated 10 mm towards the affected

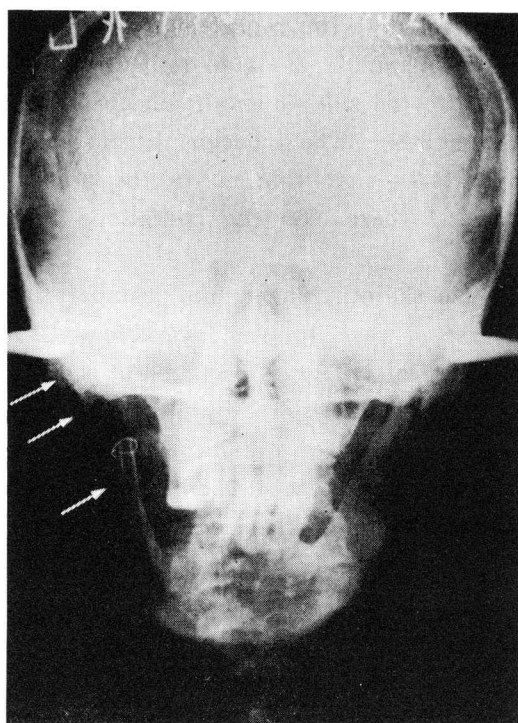


Fig. 2—Postanterior radiograph the second year after bone regrafting of Case 1. The upper, middle and lower arrows represent condyle, primary iliac bone graft and secondary rib bone graft, respectively,

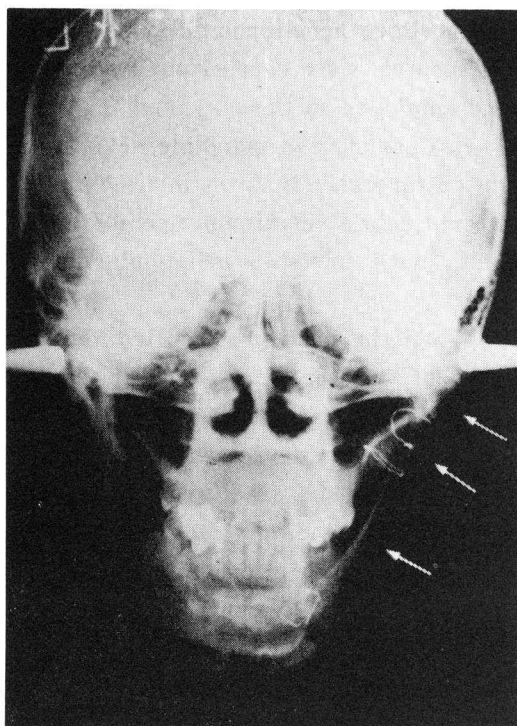


Fig. 3—Postanterior radiograph the second year after bone regrafting of Case 2. The upper, middle and lower arrows show the condyle, primary iliac bone graft and secondary rib bone graft, respectively.

side in Case 1, whereas no such deviation occurred in Case 2.

In both patients, a partial denture was favorably applied over a period of 2 years.

Two Cases of Bone Graft-fracture

Diffuse painless swelling was seen on the left cheek in Case 3 and on the left mental region in Case 4, showing relatively sharp-demarcated swelling in the corresponding alveolar portion. In Case 3 multilocular bone resorption was noted on the x-ray picture, from the second left lower molar region to the region of the mandibular ramus and in Case 4 from the right lower lateral incisor region to

the left lower second premolar region. (Fig. 1. 3-A, 4-A).

Operations were therefore performed under general anesthesia. In Case 3, disarticulation of the temporomandibular joint was performed beginning from the left second molar region, followed by elongation bone grafting with a 7 cm piece of ilium. In Case 4, a discontinuous resection of the mandible was performed beginning from the region of the right lower lateral incisor to the region of the left lower first molar, followed by bridge bone grafting with a 7 cm piece of ilium. Further procedures which involved maxillomandibular fixation, bone ligations and packing with an abundance

of cancellous hematopoietic bone and tight sutures, were carried out by the method employed in Cases 1 and 2.

In Case 3, the mandible deviated 20 mm postoperatively from midline to the affected side at maximum opening of the mouth with unstable mandibular movements.

When the patient consulted our department 1 year and 4 months later, the deviation had reached 30 mm. The right cheek was depressed and the x-ray finding revealed a fracture of the graft at the right mandibular angle with considerable bone resorption (Fig. 1. 3-B). After 1 year and 10 months, a 9 cm piece of bone was taken from the contralateral iliac crest and a piece 8.5 cm in length was regrafted so that it reached the arti-

cular fossa. After regrafting, the midline of the mandible deviated only 10 mm to the affected side at maximum opening of the mouth. The subsequent course has been fairly favorable up to the present time, 2 years after the operation (Fig. 4).

On the other hand, the postoperative course in Case 4, was favorable until a fracture of the graft occurred at the site where the outer cortex was removed for reconstruction of the mental portion 3 months after the operation, with a resulting deviation to the medial side of the mandible (Fig. 1. 4-B). Therefore, at 5 months after the operation, a piece of bone 1.5 cm in length was removed from the lower border of the premolar portion

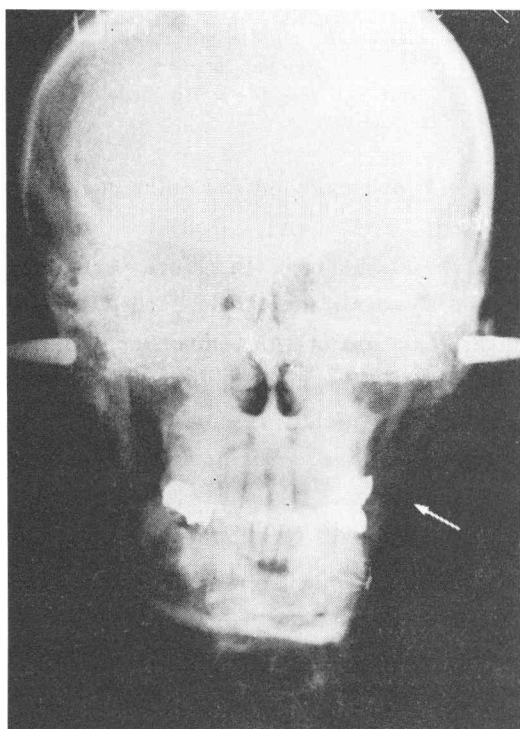


Fig. 4—Postanterior radiograph the second year after iliac bone regrafting (arrow) of Case 3.

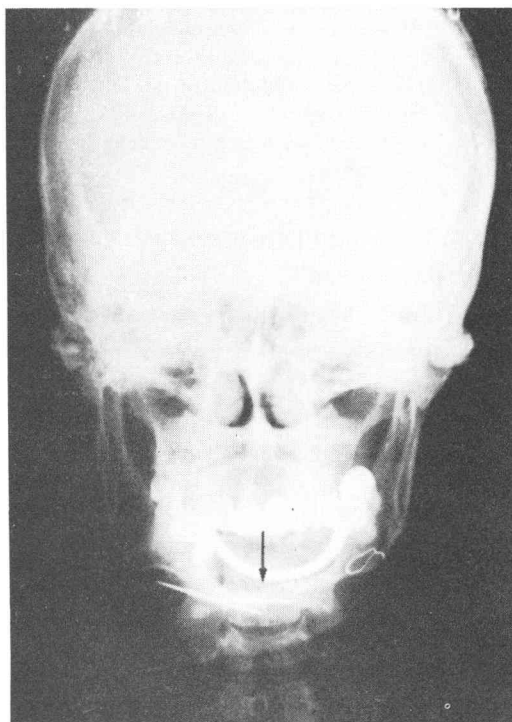


Fig. 5—Postanterior radiograph the 4th year after inferior border regrafting (arrow) and two Kirschner wires fixation of Case 4. The junctional portion of bone regrafting is obscure.

of the mandible of the healthy side with an airdrill and was grafted, followed by fixation with two Kirschner steel wires (Fig. 1. 4-C). Seven months later, the patient fell accidentally striking the mental portion, so that fracture of the graft occurred again with a mild deviation.

A bridge denture was applied and fixed. Due to the reinforced support by two Kirschner wires the movement of this part was kept to a minimum, preventing an abnormal occlusion (Fig. 5).

Though the mental prominence receded somewhat thereafter, no abnormality was found in the movement of the mandible and the patient has enjoyed a favorable course up to the present time, 3 years later.

A Case with Pseudoarthrosis

In Case 5, a full denture was applied to the maxilla and mandible and a swelling with relatively sharp-demarcation from the right lower first premolar region to the second molar region was noted. x-ray revealed, multilocular bone resorption from the right lower canine region to the lower part of the right mandibular ramus (Fig. 1. 5-A).

Under general anesthesia, a discontinuous resection of the mandible was performed from the right lower canine region to the lower part of the mandibular ramus, followed by bridge bone grafting with a 7 cm piece of ilium. For the edentulous jaw, an acrylic splint was applied and fixation was accomplished by circumferential wires around the bilateral zygomatic process and the mandible of the healthy side over a period of 60 days. Around the third month thereafter, pse-

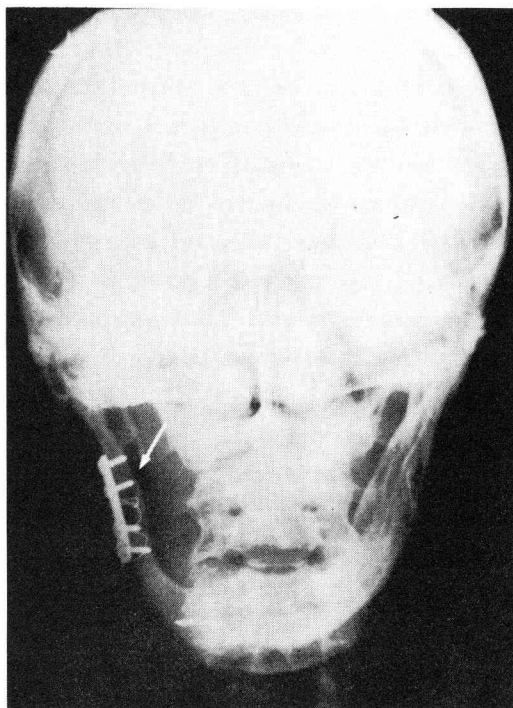


Fig. 6—Posterior radiograph the second year after metal plate fixation and the iliac bone regraft (arrow) of Case 5.

udoarthrosis was noted at the junction of the mandibular angle, and bone resorption was confirmed at the same site in the 12th month (Fig. 1. 5-B). In the 14th month, the pseudoarthrosis was fixed with a metalplate, followed by additional bridge bone grafting of a 3 cm piece of ilium with circumferential wiring fixation with No. 18.8 steel wires (Fig. 1. 5-C). Since sufficient fixation was thus accomplished, the maxillomandibular fixation was no longer necessary.

After 3 months, a full denture was applied and the patient has enjoyed a favorable course up to the present time, 1 year later (Fig. 6).

Discussion

Bone grafting was reported as 88.0%

successful by Blocker²⁾, 87.0% by Macomber³⁾ and 79.7% by Benoist⁴⁾. However, to compare the results is considerably difficult because the influence of the methods and the times of grafting and the various kinds of disease must be considered. The most frequent cause of failure is postoperative secondary infection to the hematoma and the dead space left at the time of bone grafting.

Postoperative infection with ameloblastoma was noted in Cases 1 and 2 of relatively advanced ages (39 and 59 years). On account of severe swelling of the mandibular tumore not only toward the buccal but also toward the lingual side, dead space was found at the time of bone grafting on the medial side of the graft and this was probably responsible for the failure. In order to restore the symmetry of the face, a piece of ilium with too much curvature for the mandibular angle was placed too far on the buccal side, providing another source of dead space. As a prophylactic measure, the surrounding soft tissue should be approximated to the graft as tightly as possible through 1) using circumferential sutures^{5,6)} at the time of grafting the ilium, 2) drilling holes in the bone graft when rib was used, and suturing the soft tissue¹⁾ and 3) grafting, if possible, to the medial side for the prevention of dead space.

Since the scarring of the surrounding soft tissue is too great on delayed bone grafting, attempts must be made to prevent postoperative infection for functional recovery rather than for the contour of the mandible.

Since a piece of bone from a rib has

little curvature, it has some disadvantages for the anatomical restoration of the mandibular angle. However, the flat and relatively smooth surface of the bone from a rib facilitates a tight adherence to the surrounding soft tissue which is an advantage in preventing dead space⁷⁾.

The cause of fracture of the graft in Case 3 was probably due to positioning the graft too far on the buccal side for anatomical restoration of the mandibular angle and the instability of mandibular movement of the elongated bone graft, permitting an abnormal amount of external force. For the reconstruction of the temporomandibular joint^{8,9,10)}, either grafting a piece of bone with sufficient length to reach the articular fossa or bridge bone grafting with a maximum preservation of the condyle should be performed to stabilize mandibular movement^{11,12)}. In Case 4, a part of the outside cortex of the graft was removed in order to adjust the conditions around the mental portion, and this probably weakened the graft and caused the subsequent fracture. Therefore, the reconstruction of the mental portion by the use of the U-type graft^{12,13)} and bent rib graft^{14,15,16)} appears to be more reasonable in such a case. Since the mental prominence receded slightly on account of a fracture in this patient, a regrafting will be attempted in the future.

Probably, because of insufficient fixation of the mandible and a strong occlusion, following the application of full maxillary and mandibular dentures in the third postoperative month, pseudoarthrosis was formed in Case 5. Consequently, a more secure fixation of the junction

appears to be necessary in edentulous patients than in the dentulous ones. The degree of fixation was increased by the combined use of a metal plate and bone graft^{4, 15, 17, 18, 19)} along with an additional bridge bone graft from the ilium to repair a somewhat depressed mandibular contour.

Summary

The main causes for the unsatisfactory results following mandibular reconstruction and the procedures were as follows : Postoperative infection in two patients was caused by dead space on the medial side of the graft at the mandibular angle. After removal of a part of the graft, reconstruction was again performed using a rib graft. Among two patients with fracture of the graft, uns-

table mandibular movement due to elongation bone grafting was responsible in one patient, and re-reconstruction through bone re-grafting from the ilium was performed. In the other patient, removal of part of the outer cortex of the bone graft for reconstruction of the mental portion was responsible and fixation with two Kirschner wires was performed after grafting the lower border of the mandible. In one edentulous patient with pseudoarthrosis, fixation at the junction was insufficient. A fixation using a metal plate and an additional bridge bone grafting was performed. In all five patients a denture was applied and the contour and function of the mandible were favorable over a period of 2 or 3 years after bone re-grafting.

内容自抄 : 我々は1965年から1976年までの過去12年間に、下顎骨の良性腫瘍28症例に対し、顎切除後に骨移植による再建術を実施した。最近、これらの予後を追跡調査した結果、5例の広範なエナメル上皮腫例に術後の異常経過が認められていた。そこでこれらの原因と再骨移植処置について以下のような検討を加えた。

2例の術後感染例では、下顎角部の内側に死腔を残したことに起因するものと思われ、これらは移植骨の一部を摘出後に肋骨移植による再々建を行った。また2例の移植骨骨折のうち、1例は延長骨移植による不安定な下顎運動に起因するものと思われ、腸骨の再移植による再々建を行った。他の1例はオトガイ部形成のため、移植骨骨皮質の一部を削除したことに起因するものと思われ、下顎骨下縁の移植と同時にキルシュナー鋼線を使用して固定した。偽関節形成の1例は、無歯顎例で接合部の固定が不十分であったので、金属プレートと腸骨の添加移植を追加した。

以上、5例とも再骨移植処置を追加することによって、2～3年後の現在、義歯が装着され、形態的ならびに機能的に良好に経過している。

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