

BONE GRAFT INTO ANTERIOR ARCH DEFECT OF LOWER JAW:

Report of a Case

BY

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ABSTRACT

Treatment of an ameloblastoma in the anterior arch of the mandible is described. Immediate reconstruction after a wide resection of the mandible was made by the use of two pieces of iliac bone. A unique appliance of external pin fixation has been used for immobilization of the mandible. This appliance is recommended for intermaxillary fixation of edentulous mandible.

INTRODUCTION

Loss of a portion of the mandible interferes with the normal functional and esthetic qualities of the lower third of the face. Especially, when the anterior arch of the mandible must be sacrificed, the deformity becomes most remarkable. The resultant deformity is so intolerable that immediate reconstruction might be desirable. However, construction of the curve of the anterior arch with a bone graft is very difficult. Various attempts have been made, and Millard¹⁾ reported a technique using a 6-inch rib bone graft with Kirschner wire. Kazanjian²⁾ has shown almost complete reconstruction of the mandible by joining together several pieces of iliac bone. According to Dingman³⁾, the ilium offers a suitable bone for the reconstruction of any part of the mandible.

In bone grafting into anterior arch defect of the mandible, immobilization is one more difficult problem because of the absence of adequate mandibular teeth. If teeth are present in both jaws, and in the anterior and posterior fragment, there is no difficulty in achieving immobilization. In edentulous cases, external method of fixation is recommended but, as the choice of fixation method depends on various factors, we must try to devise an appropriate appliance for each case.

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Received for publication, March 8, 1971.

This paper discusses the treatment of an ameloblastoma of the mandible occurring in the anterior arch. Immediate reconstruction after a wide resection of symphysis and body of mandible was made by the use of two pieces of iliac bone. A unique appliance of external pin fixation has been used for immobilization of the mandible.

REPORT OF A CASE

A 31-year-old Indonesian male came to our clinic on May, 1969, complaining of a swelling of anterior arch of his mandible. He was not aware of the swelling of his lower jaw until one of his friends noticed it four years ago. He visited a hospital in Indonesia and was treated by curettage of the tumor. At that, the swelling of his jaw found histologically to be ameloblastoma. Three years had passed after the operation without significant change. However, about a year ago, when he set a partial denture on the anterior arch of lower jaw, the denture did not fit in his mouth and he became aware of the recurrence of his disease. When he visited the same doctor again, the resection of mandible was suggested and he came to our clinic.

Physical Findings: The man was slightly obese, well developed and well nourished, and not acute distress. There was an external swelling in the anterior arch of his mandible (Fig. 1). The lesion was covered with the normal skin and on external palpation it was quite hard, neither painful nor tender except when firm pressure was applied. The intraoral swelling extended from the mesial portion of the right first molar to the left second premolar area (Fig. 2). The swelling obliterated the mucobuccal fold and extended to the lingual portion, especially on the right side. The mucosa overlying the lesion was rather red. Palpation revealed absence of a considerable portion of lingual plate. The motion of right first and second premolar was remarkable.

Diagnosis: Radiographs revealed a large osteolytic lesion of the symphysis and body of the mandible, from the right first molar to the left second premolar (Fig. 3). The lesion did not appear to involve the inferior border of the mandible. The X-ray films showed a large monolocular radiolucency on the right side of the body of mandible but the other portion of the symphysis appeared to be multiloculated. The remainder of the physical examination and laboratory studies were essentially within normal limits. A biopsy was taken of the overlying mucosa and the inner lining of the cystic lesion at the right premolar area. The overlying mucosa evidenced normal squamous epithelium, whereas the cystic lining showed a typical cyst wall lined by cells suggestive of ameloblastoma.

Hospital Course: On the basis of the radiographs and the pathological



Fig. 1. Preoperative facial appearance.

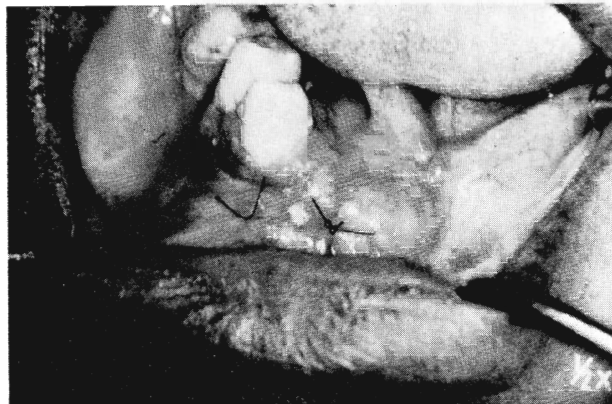


Fig. 2. Intraoral view of expanded region of anterior arch.

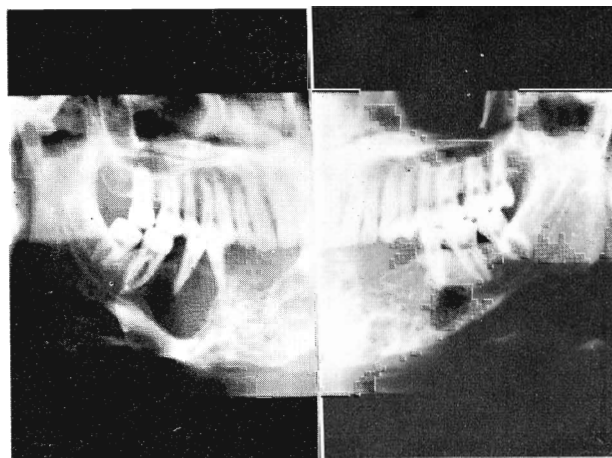


Fig. 3. Panorex radiograph showing a large osteolytic lesion of the symphysis and body of the mandible.

report, decision was made for the surgical resection of the mandible and insertion of an immediate iliac bone graft on both sides at once. Before the patient entered the operating room, the following parts were prepared for mandibular fixation: Intraoral rod, extraoral frame, and Matsuki's bone clamps and pins (Figs. 4 and 5). Intraoral rod and extraoral frame

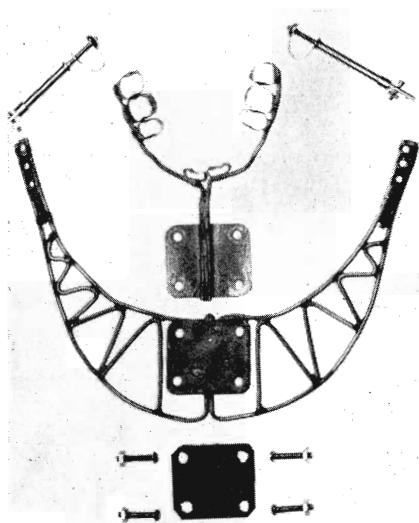


Fig. 4.

Fig. 4. The appliance for mandibular fixation (Matsuki's bone clamps and pins, intraoral rod, extraoral frame, and rubber plate).

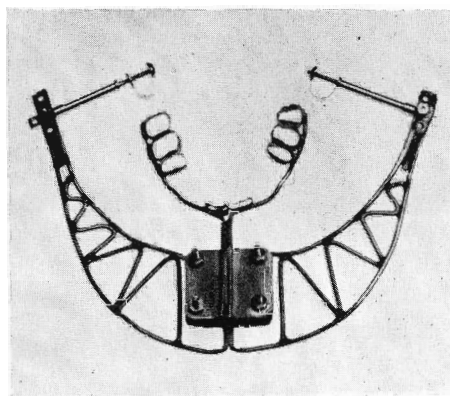


Fig. 5.

Fig. 5. The appliance ready for use.

were made of nickel-silver wire. Orthodontic bands were prepared for upper teeth (7651/1567), and intraoral rod was bent to fit the upper teeth, extending to outside of the mouth. Then the rod was soldered to each of the orthodontic bands. Extraoral frame was adjusted to the outline of the cheeks in a horizontal direction from the mandibular angle to the mouth on each side.

Surgery: Halothane was administered to the patient through a nasotracheal tube. Two pieces of 7 cm long section of bones were removed from the right and left iliac crest to be used as immediate grafts. While the orthopedic procedure was in progress, the external procedure was begun in the usual manner. An incision was made from the left to the right angle of the mandible. Dissection was carried to the body of mandible. A lateral cortical expansion from the left to the right premolar was observed. Some parts of the bone were absorbed with the tumor, and the dissection was very difficult because of the firm attachment of mucosa

to the tumor. The mandible was sectioned through the portion of the first molar at each side, well beyond the tumor with reference to the X-ray film. After excision of the tumor, immediate bone graft was made with

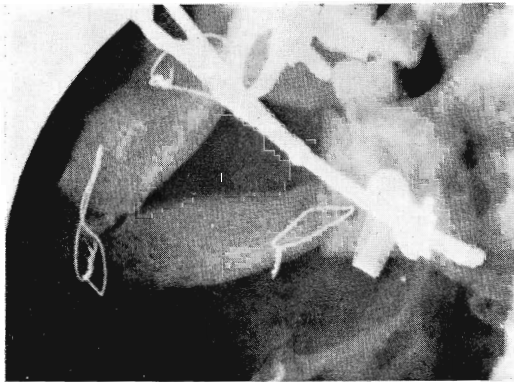


Fig. 6.

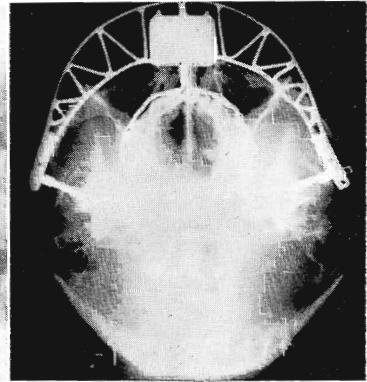
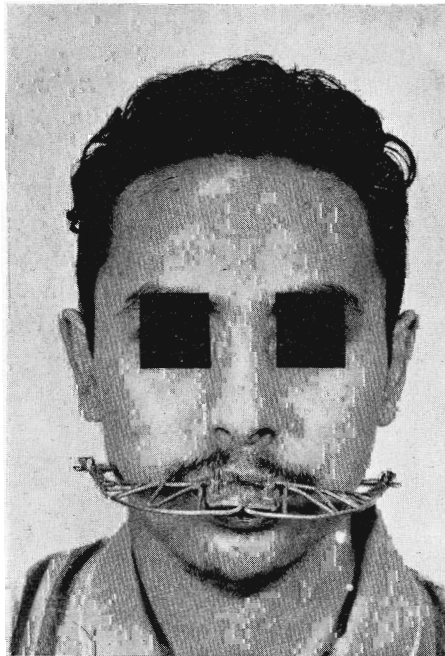


Fig. 7.

Fig. 6. Radiograph shows good continuity and contour of reconstructed mandible.
Fig. 7. Radiograph shows the appliance fixed to the correct position.

Fig. 8.



Left



Right

Fig. 8. Front and lateral views of the appliance as used in the fixation technique.

the right and left iliac bones. The bone grafts were trimmed and contoured on each side. A mortise joint was formed anteriorly and posteriorly to fit each other. The grafts were interlocked and wired to each other with 18/8 stainless steel and to the proximal and distal segments of the mandible (Fig. 6). Then the Matsuki's bone clamps were attached to the inferior border of the mandibular angle and pins were inserted and secured with the clamps. The pins go through the external cortex of the mandible through the medulla of the bone and impinges the internal cortex of the mandible. When each fragment was fixed with two pins, it was fixed to the proper position by connecting with the terminal holes of the extraoral frame (Fig. 7). Then the extraoral frame was attached to the intraoral rod with 30×25 mm rectangular brass plate in front of the mouth (Fig. 8). Between the two brass plates, rubber plates were placed to tighten the intimate contact. After all the parts of the appliance were fixed with screws and bolts, muscle and periostium were closed firmly around the graft to obliterate the dead space, and the remaining layers of the wound were closed. A nasogastric tube was placed before extubation and the patient was taken from the operating room in satisfactory conditions.

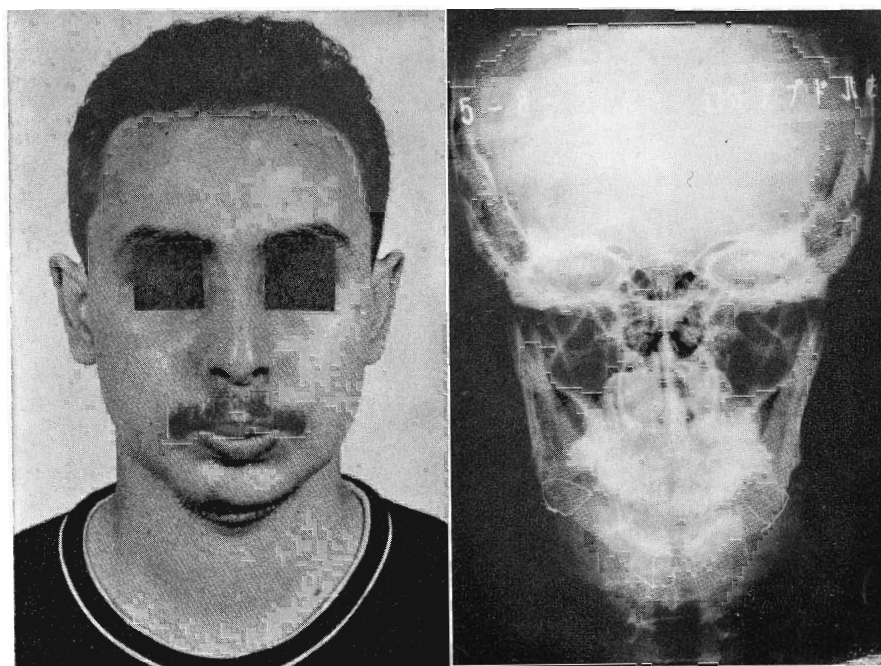
Post-operative Course: Except for soft tissue edema, the immediate postoperative period was uncomplicated. After surgery, Cephaloridine was administered intramuscularly daily and intermittent cleansing of the pin-skin penetration sites was made with hydrogen peroxide. The patient continued to become well and his swelling decreased. Radiographs taken 3 months after insertion of the graft showed no abnormality and the bone clamps and pins were removed (Figs. 9 and 10). Paresthesia still persisted on the lower lip.

Pathologic Diagnosis: The specimen consisted of symphysis and body of mandible from the left to right molar portion (Fig. 11). Sections of the monolocular type showed a large cystic wall. It was lined with squamous epithelium and tumor cells resembling stellate reticulum (Fig. 12). The other part showed a solid type of ameloblastoma. These cells were arranged in cord or strands of only one or two cells in thickness.

DISCUSSION

It has been emphasized by a number of workers⁴⁻⁷⁾ that, since the ameloblastoma is an invasive, clinically malignant tumor, the only rational treatment is its complete removal. Before coming to our clinic, this patient also attempted curettage in an Indonesian hospital, but the tumor recurred after four years. According to the previous data, an inadequately treated ameloblastoma may recur after several years. Therefore, curettage has no

Fig. 9.



Left

Right

Fig. 9. Left: Postoperative facial appearance. Right: Postoperative postanterior view.

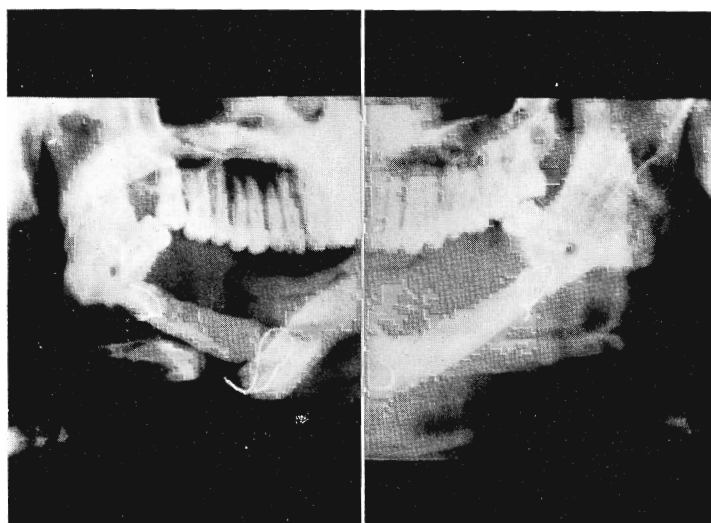


Fig. 10. Postoperative Panorex radiograph.



Fig. 11. Radiograph of the surgical specimens.

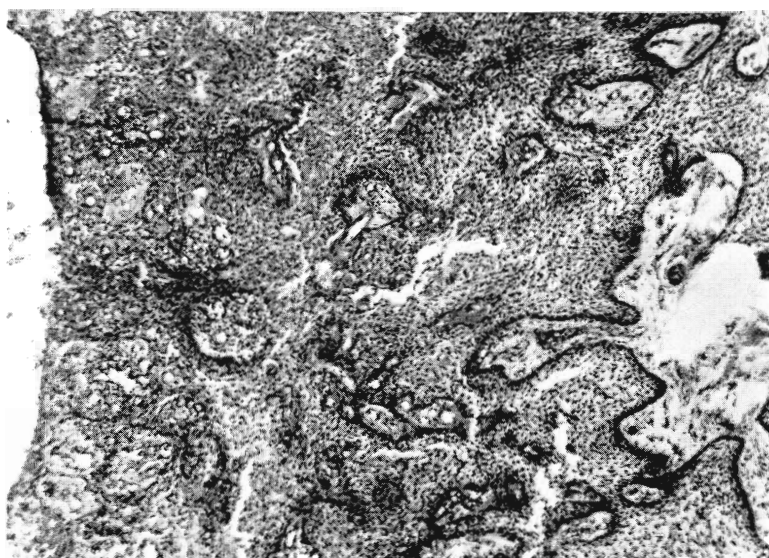


Fig. 12. Photomicrograph of tumor cells resembling stellate reticulum ($\times 50$).

legitimate place and the treatment of choice is excision en bloc with an adequate margin of healthy tissue.

In some instances, the en bloc excision of tumor does not disrupt continuity of the jaw, but frequently a complete segmental resection is necessary. In such cases, we must try to avoid a disfiguring defect or deformity in order to preserve patient's appearance.

There were so many efforts of surgeons^{6,8,9)} to discover an ideal substitute for a bone, biological or non-biological, in the reconstruction of defect of the face and skull. However, each of these substitutes present certain, undesirable features which does not make them ideal for bone substitution. There are various methods for reconstruction, such as the use of a rib, iliac crest, Silicone, Teflon, and metallic implant. Stone, in 1965¹⁰⁾, reported a case of ameloblastoma in which a portion of the mandible was corrected with the use of a measured segment of the eighth rib on the same side. To date, the most satisfying general and overall results have been found in our hands from the use of a fresh autogenous iliac bone. This bone is a desirable source of material for several reasons³⁾. Iliac bone is easily available because of its accessibility and may be removed in a large amount from one or both ilia. It possesses the qualities of rigidity and workability which are highly desirable as a source of graft material for correction of facial defects. Because of the thin cortex and the relatively large amount of cancerous bone, it is the bone most likely to take in its new situation. The minimal disability, even after removal of very large sections of the ilium, is remarkable. In most cases, the patient is able to be up and has complete recovery of the function within a week or two.

Many cases of segmental mandiblectomy for ameloblastoma have been reported in the literature^{4,6,11,12)}. There are two different procedures for a bone graft, immediate and delayed reconstruction after surgery. Often the nature and extent of malignant tumors require delayed reconstruction of the resected mandible. However, in removal of the mandible for ameloblastoma, extent of the resection rarely results in gross soft tissue defects. With the development of antibiotics, there is no reason to defer reconstruction of the mandible after surgery for ameloblastoma^{4,5,6,11,13,14)}. Obwegger¹⁵⁾ also demonstrated the success of transplantation of large bone segment to infectious regions in the oral cavity.

According to Dingman³⁾, even a large segment of bone loss, involving the symphysis and body of the mandible on each side, can readily be reconstructed with a section of bone removed in a semicircular pattern from the superior crest of ilium. However, as it is deficient in its vertical dimension, we have tried to use two pieces of bone from the crest of iliac ridge to form a U-shaped section in the vertical relationship.

One of the important factors in bone grafting is the efficiency of immobilization. The prepared graft must be placed and maintained in intimate and immobil contact with the host-bone fragment. Immobilization must be kept until bony union has occurred. Although there are so many varied methods and appliances for immobilization, the control of remaining jaw fragments after partial resection is sometimes very difficult in the ab-

sence of adequate teeth. Thoma⁶⁾ described various external methods of fixation recommended in fracture of edentulous maxilla and mandible. In bone grafting, skeletal fixation with a peripheral bone clamp has been found effective. According to Thoma⁶⁾, these appliances are head appliances combined with various types of splints and pins. The most famous device seems to be the external pin fixation appliance¹⁶⁾ as described by Anderson^{17,18)}. Sometimes additional stability can be obtained by placing an intraosseous Kirschner wire, stainless steel plates, or tantalum trays. However, in addition to these external pin fixations, a head appliance is needed in order to strengthen the stability and to keep an interrelation between upper and lower jaws. At present, the most commonly used head appliance is the plaster head cap. This device, however, has many faults such as being unstable, uncomfortable, heavy, bulky, irritating to bed-fast patient, and so on. Recently halo head frame was used instead of head plaster by Panuska¹⁹⁾ and he reported an excellent result. However, such a head appliance is not useful if the use of cranial fixation is contraindicated because of scalp or skull injuries.

In the bone graft to the edentulous mandible and teeth present in the maxilla, a unique appliance has been used during the past years in our clinic²⁰⁾. This appliance is an intraoral and extraoral intermaxillary fixation consisting of three parts, mandibular bone clamps and pins, extraoral frame, and intraoral rod. Intraoral rod is soldered to the maxillary teeth with orthodontic bands. It is a type of the winged maxillary splint described by Thoma⁶⁾. External pins, attached to the host-bone fragments with bone clamps, are connected to the intraoral rod by means of an extraoral frame. This method provides firm fixation of the mandibular host-bone fragment to the maxilla and revealed various advantages compared to the head appliance. This is recommended for intermaxillary fixation to the edentulous mandible.

ACKNOWLEDGEMENT

We wish to express our appreciation to Dr. Hideo Ito, Professor of oral surgery of this University, for his valuable advice.

REFERENCES

- 1) Millard, D. R., Maisels, D. O., and Batstone, J. H. F.: Immediate repair of radical resection of the anterior arch of the lower jaw. *Plast. Reconstr. Surg.*, 39: 153-160, 1967.
- 2) Kazanjian, V. H., and Conover, J. N.: The surgical treatment of facial injuries. 2nd ed. Williams & Wilkins Co., Baltimore, 1959.

- 3) Dingman, R. O.: The use of iliac bone in the repair of facial and cranial defects. *Plast. Reconstr. Surg.*, 6: 179-195, 1950.
- 4) Shatkin, S., and Hoffmeister, F. S.: Ameloblastoma: a rational approach to therapy. *Oral Surg. Oral Med. Oral Path.*, 20: 421-435, 1965.
- 5) Johnson, R. H., and Topazian, R. G.: The management of variants of ameloblastoma. *Plast. Reconstr. Surg.*, 41: 356-363, 1968.
- 6) Thoma, K. H.: *Oral surgery*. 4th ed. C. V. Mosby Co., St. Louis, 1963.
- 7) Archer, W. H.: *Oral Surgery*. 4th ed. W. B. Saunders Co., Philadelphia and London, 1967.
- 8) Kruger, G. O.: *Textbook of oral surgery*. 3rd ed. C. V. Mosby Co., St. Louis, 1968.
- 9) Mohnac, A. M.: Gross loss of mandibular hard structure. *J. Oral Surg.*, 27: 508-519, 1969.
- 10) Stone, J. W.: Segmental mandibulectomy with rib graft for ameloblastoma. *Arch. Otolaryngol.*, 82: 186-188, 1965.
- 11) Anlyan, A. J.: Immediate reconstruction of mandibular defects with autogenous bone chip grafts. *Amer. J. Surg.*, 110: 564-567, 1965.
- 12) Weinstein, I. R.: Bone grafting after mandibular resection. *J. Oral Surgery*, 26: 17-32, 1968.
- 13) Conley, J.: A technique of immediate bone grafting in the treatment of benign and malignant tumors of the mandible and a review of seventeen consecutive cases. *Cancer*, 6: 568-577, 1953.
- 14) Caldwell, T. A., and Siparsky, M. S.: Immediate mandibular reconstruction with iliac bone after surgery for ameloblastoma. *J. Oral Surg.*, 28: 386-392, 1970.
- 15) Obwegger, M.: Simultaneous resection and reconstruction of parts of the mandible via the intraoral route in patients with and without gross infections. *Oral Surg.*, 21: 693-705, 1966.
- 16) Khedroo, L. G.: External pin fixation for treatment of mandibular fractures: a reappraisal. *J. Oral Surg.*, 28: 101-108, 1970.
- 17) Anderson, R.: Ambulatory method of treating fractures of the shaft of the femur. *Surg. Gynecol. Obstet.*, 62: 865-873, 1936.
- 18) Anderson, R.: Ambulatory method of treating femoral shaft fractures, utilizing fracture table for reduction. *Amer. J. Surg.*, 39: 538-551, 1938.
- 19) Panuska, H. J., and Dedolph, T. H.: Extraoral fraction with halo head frame for complex facial fractures. *J. Oral Surg.*, 23: 212-221, 1965.
- 20) Ueno, T., et al.: Ganmen gaisho no rinsho (Clinic of maxillofacial trauma). Chugai Igaku Co., Tokyo, 1968.