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RECONSTRUCTION OF MANDIBULAR DEFECT WITH COMPOSIITE AUTOGENOUS ILIAC BONE AND COSTOCHONDRAL GRAFTS

Se-Hong Chang, D.D.S., Jye-Jynn Ann, D.D.S.
Jae-Jung Soh, D.D.S., Chi-Hee Park, D.D.S.
Dept. of Dentistry, Oral and Maxillofacial Surgery, Taegu Fatima Hospital

Loss of mandibular continuity due to neoplasm, trauma, or infection results in major esthetic and biologic compromise. The use of costochondral grafts for reconstruction of temporomandibular joint, described first by Gillies in 1920, has been accepted as a suitable method for replacing the mandibular condyle, especially in growing children. Autogenous iliac bone graft has been a satisfactory source of mandibular reconstruction since Sykoff's report in 1900. Autogenous bone grafts from the posterior aspects of the ilium provide large amount of PMCB with acceptable donor site morbidity.

In timing of reconstruction, initial disease, age, medical history, growth and development, esthetic and psychologic factors should be considered.

We present a case of osteosarcoma in the mandible that was treated by a hemimandibulectomy and the defect was reconstructed 20 months later with composite method of costochondral and posterior iliac bone graft.

I. INTRODUCTION

There have been numerous experimental and clinical investigations that attempted to improve anatomic reconstruction and functional rehabilitation after loss of mandibular continuity because of pathologic conditions or accidental or surgical trauma[1]. Methods and materials for mandibular reconstruction are free bone graft, composite graft, free and pedicle compound flaps, vascalarized bone graft, and various implants[2,3,4].

Maxillofacial osseous defects require particular attention to grafted tissues that have osteogenic potential[1]. Sykoff[3] was the first to reconstruct the mandible with an autogenous bone graft in 1900 and the use of costochondral grafts for reconstruction of the temporoma··dibular joint was first described by Gillies [5] in 1920.

Because of biologic and anatomic similarities to the mandibular condyle, autogenous costochondral grafts have been considered to be the most acceptable tissue for temporomandibular joint reconstrution, especially in growing children[6,7]. The advantages of costochondral graft are capacity of growing and adaptation, possible fashioning, similar functional capabilities of the mandibular condyle, and rare donor site complications[2].

Application of autogenous particulate marrow and cancellous bone(PMCB) has been shown to provide superior osteogenic induction properties, quicker revascularization, higher resistance to infection, and greater susceptibility to remodeling as compared with a solid graft[8]. There are several introduced devices to support PMCB and to make amorphous graft the desired shape, such as metal trays (stainless steel tray, vitallium porous tray or titanium mesh), Dacron-urethane mesh, freeze-dried allogenic mandi-

ble or rib, and autologous mandible or rib[2,6].

The advantages of composite graft using autogenous rib and PMCB are better chance of survival of graft through immediate fixation, superior osteogenic induction property, quicker revascularization and higher resistance to infection[6].

We report a case of osteogenic sarcoma in the mandible that was treated by a hemimandibulectomy including condyle, and the defect was reconstructed 20 months later with composite method of costochondral and posterior iliac bone graft.

II. REPORT OF A CASE

A 15-year-old male patient was seen at our service complaining of a continued painful swelling at the left mandibular angle area(Fig. 1). Radiologic examination through mandibular series and computerized tomogram showed a expansive radiolucent lesion in the mandibular angle area with destruction of the inferior cortex(Fig. 2). Microscopic examination of a needle biopsy showed many scattering foci of the osteoid change with atypical hyperchromatic cell reaction. The histologic diagnosis was osteogenic sarcoma. So the patient underwent the radical excision of the lesion from the distal of canine tooth including left mandibular condyle and the surgical defect was temporarily reconstructed with resin implant fixed to the remaining mandible using compression plate and screws.

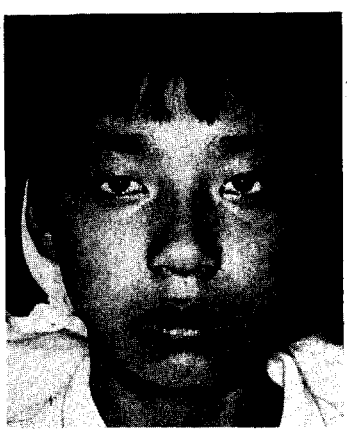

Fig. 1. Preoperative frontal view at initial visit.

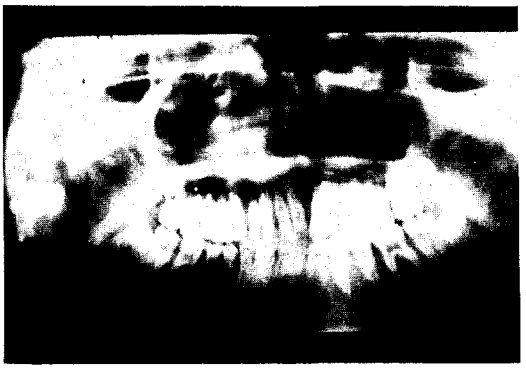

Fig. 2. Preoperative panoramic view showing radiolucency in left mandibular angle area.

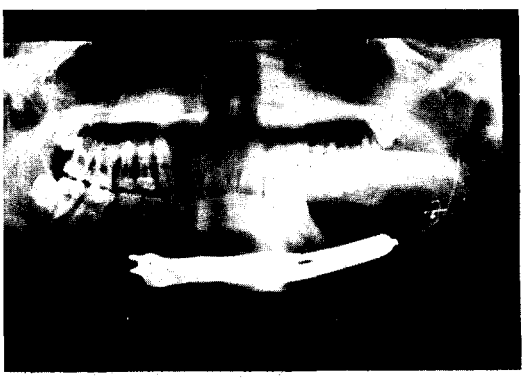

Fig. 3. After mandibular resection, temporary resin splint was applicated.

After 14 months, considerable amount of bone regeneration was seen in panoramic view but no further regeneration was observed at regular follow-up X-rays(Fig. 3). Since there has been no evidence of recurrence for about 20 months, secondary reconstruction was planned. Considering his age in growing period and for preservation of temporomandibular joint function, costochondral and autogenous cancellous bone graft as sandwiching method was chosen. For obtaining large amount of cancellous bone and marrow, posterior iliac approach was done. Using 5th rib, contralateral to the defect of mandible, as supporting device for PMCB, permanent reconstruction of mandible was performed(Fig. 4). The obtained 5th rib was then split along the axis extending through the greatest width of the rib to 3cm below the costochondral end of the rib. The rib was fashio-

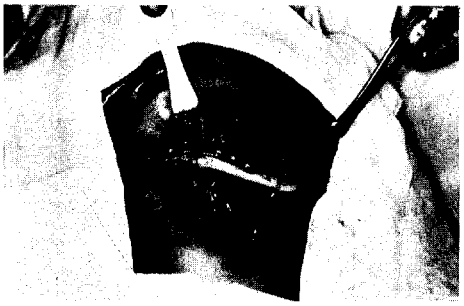

Fig. 4. Temporary resin splint just before removal.

Fig. 5. Split rib fixed to the remaining mandible showing space for packing PMCB.

Fig. 6. PMCB was sandwiched between the split rib.

Fig. 8. Intraoral view showing increased degree of mouth opening.

Fig. 7. Postoperative facial photograph showing improved appearance.

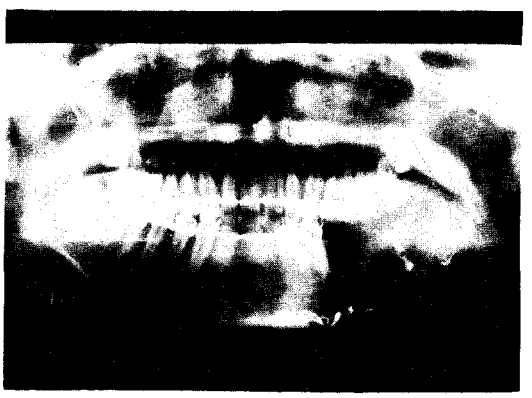

Fig. 9. Nine month postoperative panorama with good maintenance of the graft.

ned to fit the defect and was positioned with the costochondral portion articulating in the glenoid fossa. The rib was stabilized with the remaining mandible at symphyseal area using rigid fixation and wiring (Fig. 5). The cancellous marrow bone obtained from the posterior iliac crest was sandwiched between the split rib(Fig. 6). Presently we can see the good looking facial symmetry and appearance with increased degree of mouth opening, good result of graft taking and preservation in radiograms(Fig. 7, 8, 9).

III. DISCUSSION

Costochondral graft has been accepted for many years as a suitable method for replacing the mandibular condyle, especially in growing children[6]. This type of graft allows for facial growth as well as provides a functional joint. In addition, donor site complications are infrequent and regeneration of rib usually occurs within a year postoperatively . After first description by Gillies, the scientific merit of costochondral graft was established by Poswillo in 1974, and further encouraged by MacIntosh and Henny in 1977[5,9].

Five major indications for costochondral graft exist : reconstruction following tumor surgery, correction of facial deformities, ankylosis, post-trauma reconstruction, and for replacement of arthritic joint [9].

The early use of costochondral grafting for TMJ reconstruction was based on the empiric assumption that cartilage would provide a durable, smooth articulating surface that would resistant to ankylosis and have the capacity for adaptation. Costochondral grafting in these situations occasionally results in the resumption of mandibular growth. Although continued and harmonious growth of the transplant is unpredictable, encouraging functional and cosmetic results have been obtained in a number of reported cases[7].

Several reports have been advocated the use of an alloplastic condylar prosthesis in adult, but the problem with this approach is that the alloplastic material has no adaptive capacity.

Nelson and Buttrum[5] in 1989 reported that autogenous costochondral graft affords the opportunity for the reattachment of the lateral pterygoid and thus a potential for reestablishing excursive movement which is not possible in alloplastic condyle prosthesis. MacIntosh[5] has stated that another advantage of the costochondral graft is that it can be placed in a fossa devoid of disc because the rib cartilage is more tolerable and less deforming within the fossa. According to Sinn[1], among the types of viable cartilage, the hyaline cartilage obtained from the rib seems to present the best survival after transplantation.

Mandible can be considered a small vascularized bone consisting of a large amount of compact bone with lower osteogenic potential, thus the combination of rib and iliac bone seems to be a good choice[1].

Corticocancellous autogenous bone grafts from the ilium provide viable cellular and osteoconductive capacity and have been used successfully since Sykoff's[3] report. An adequate volume of corticocancellous bone can generally be harvested from the ilium, with acceptable donor site morbidity.

The particles of autogenous bone and marrow must be placed in a supporting device to form a composite bone graft. Since Richard's[2] stainless steel tray, lots of devices were introduced[6]. But there is the danger of foreign devices that the tray rim will be brought directly into contact with oral mucosa. In case of secondary infection, resolution would be difficult due to presence of tray, and it would be necessary to remove the tray. Defries et al[10] reported reconstruction cases of freeze-dried allogenic mandibles combined with PMCB. As allogenic mandible satisfies the supporting action of tray for PMCB for required period due to slow replacement than autogenous bone graft, and donor site surgery is not without associated morbidity, this could be the choice of technique. However cadaver mandible or rib is not accessible in our country therefore autogenous rib tray was introduced by the authors.

Autogenous bone is usually taken from the posterior aspect of the ilium nowadays when large amount of PMCB is needed. Postoperative problems such as donor site pain, hematoma and delayed ambulation are not common than anterior approach. Accepted disadvantages were increased operating time and the need to turn the patient during the operation[11,12,13].

Permanent reconstruction of the patient was postponed for 20 months due to possible recurrence of osteosarcoma. In general, the drawbacks of primary reconstruction are based on difficulty in wound closure and elimination of dead space and on detecting

early recurrence of malignant disease. In timing of reconstruction, initial disease, age, medical history, growth and development, esthetic and psychologic factors should be considered. But in general, reconstruction can be completed 3 months after benign tumor resection, trauma or infection, and 12 months after resection of malignant disease[3,9].

In surgical procedure, drilling holes in each half of the rib is recommended[2]. The prosthesis must be perforated to permit diffusion of nutrients to the grafted tissue from the recipient bed, drainage of breakdown products from grafted cells that undergo necrosis, and ingrowth of capillary beds. The presence of the perichondrium is considered a fundamental requirement for the vitality of cartilage grafts and their appositional growth[5,9,14]. Also elimination of dead space is emphasized by Hunsuck et al.

Inherent to the success of any bone graft is proper immobilization. When only the condyle is being replaced, the length of maxillomandibular fixation is usually 4 to 6 weeks. When a major portion of the ramus is reconstructed, 8 to 10 weeks may be required. Upon removal of maxillomandibular fixation, gentle opening exercises are initiated. In the early stages of healing, there may be often a characteristic lack of excursive movement. Patient can usually resume a regular diet at 10 to 12 weeks postoperatively.

Ⅳ. SUMMARY

A case is presented that describes a method of mandibular reconstruction using costochondral graft and split rib filled with PMCB with good result.

Postoperative facial contour and symmetry seemed to be satisfactory but the patient got keloid nature of the skin. Resultant mondibular function proved to be quite acceptible considering extensiveness of the surgical defect.

Radiographic examination of the grafted bed after 6 months showed osseous union between the composite bone graft and the host bone. In the 9th month, the graft showed partial resorption but no further resorption was identified after then. The osseous union between the graft and host bone was obvious.

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국문초록

자가장골 및 늑연골의 복합이식을 통한 하악골 재건술

대구 파티마 병원 치과 구강악안면외과
장세홍 · 안재진 · 소재정 · 박지희

외상이나 감염 또는 종양의 적출에 의해 발생한 하악골 결손부는 심미적, 기능적으로 많은 문제를 야기한다.

Sykoff가 1900년에 자가골 이식으로 하악골 결손부를 수복한 이후 현재까지 많은 이식물과 이식방법이 이용되어져 왔으며 특히 늑연골은 1920년에 Gillies에 의해서 TMJ 수복에 처음 사용된 이후 성장기 아동의 과두결손부 수복에 많이 이용되고 있다. 또한 자가장골은 안면부의 수복에 보편적으로 이용되고 있는 공급부위이며 특히 많은 양의 망상골이 필요한 경우에는 후방 접근법을 이용함으로서 충분한 양의 골을 얻을 수 있다.

수복의 시기는 환자마다 차이가 있어서 나이, 과거력, 초기질병의 상태, 성장발육정도 및 심미적, 정신적인 면을 고려하여야 하며 악성종양의 제거시에는 재발여부와 방사선 치료 등을 고려하여 적절한 시기를 선택하여야 하나, 일반적으로 술후 약 1-2년 후에 시행할 수 있다.

본원에서는 하악골 골육종으로 진단된 15세 남자 환자에서 과두를 포함하는 좌측 하악골 절단술후 임시로 레진수복물을 장착한뒤 약 20개월간의 주기적인 검진결과 재발의 기미가 없어 늑연골과 장골의 복합이식을 통하여 심미적, 기능적으로 양호한 결과를 얻었기에 그 증례를 보고하는 바이다.