Mandibular Reconstruction : Free Flap *vs* AO Plate

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Abstract

The purpose of this study was to compare the use of the AO reconstruction plate with immediate free vascularized bone graft mandibular reconstruction. From April 1989 to December 1993 we performed 13 cases of mandibular reconstruction. Reconstruction plates were used in 4 and immediate free bone grafts were used in 9 patients. The overall success rate for use of the plate was 2 of 4 (50%). In one of the plate failure patients, the plate was removed eight months postoperatively. She was able to wear a dental prosthesis. Cancer destruction and microvascular anastomosis of the first seven free flaps were performed by one surgical team. Only 4 free flaps were successful (success rate was 44%). We found that the use of AO plate with flap for lateral defect was relatively safe, simple, functional, time-saving, cosmetically acceptable and could be used successfully in post-operative irradiated patients. Success rate of the free flap was better with two surgical teams. The long-term result of the free flap was more reliable than the AO plate.

Key word : Mandibular Reconstruction : Free Flap, AO Plate

Immediate mandibular reconstruction after a mandibulectomy for oral cavity cancer is preferred to restore adequate cosmetic and function. Preference is also given to postoperative irradiation since preoperative irradiation is responsible for postoperative complications (healing problems). Aesthetic deformity and loss of function will occur if the mandible is resected. Anterior segmental resections result in medial rotation of both remaining segments combined with loss of support for the base of the tongue and hyoid bone (Andy Gump deformity).

In the past, bone graft was used for mandibular reconstruction with poor result since the nonvascularized bone was not resistant to infection from the contaminated oral cavity. When free bone grafts were employed, primary reconstruction with nonvascularized bones had a complication rates as

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high as 80 per cent, with a 50 per cent resorption rate[1]. Schmoker used an AO plate for mandibular reconstruction which is easily shaped and applied to any type of mandibular defect[2]. AO plate mandibular reconstruction resulted in cosmetic and function better than K wire, silastic, metal tray or bone graft. It had sufficient structural rigidity to maintain the mandibular fragments in proper orientation and likewise, the teeth in proper occlusion. If combined with pre or postoperative irradiation, it might have an extrusion rate of 60-80 per cent[3]. Osteomyocutaneous flap with bony donor site from rib, clavicle, scapula, outer layer of sternum or outer cortical table of the skull has been described. The blood supply to these attached bones is tenous at best. Success rate in nonirradiated defects was 35 per cent, in irradiated defects was 15 per cent[4,5]. When free flap was developed, the infection rate was reduced because of a high blood level of antibiotic in the vascularized bone. Numerous donor sites are available to match the defects.

Gullane reported a 78.9 per cent success rate in the combination of an AO plate with a flap in 64 pre or postoperative irradiation patients. A radiation dosimetric model was employed using a parallel pair of beams on plate. He found that patients with plates could be treated safely with postoperative irradiation using either cobolt-60 or 6-mV energy[6,7].

In this study, we compared the use of free flap and AO plate followed by postoperative irradiation in mandibular reconstruction.

MATERIAL AND METHOD

From October 1989 to December 1993, 13 patients underwent mandibular reconstruction. There were 6 males and 7 females, ranging in age from 36-76 years (average 60.7 years). The range of the follow-up period was 1 to 66 months (average 21.3 months) (followed until June 1995). All of the histopathology was squamous cell carcinoma. The tumors originated at the floor of the mouth (4), at the alveolar ridge (4), at the retromolar trigone (2), at the buccal mucosa (2) and at the tongue (1). Four patients were stage III and nine patients were stage IV. (American Joint Committee on Cancer Staging 1988) (Table 1, 2). Nine patients were reconstructed with a free flap; scapular (4), fibular (3) and radial forearm (2). The first seven free flap patients, cancer destruction, flap harvesting and microvascular anastomosis were operated by one surgical team.

Four patients were reconstructed with an AO plate. The technique for plate use was as follows : After the mandible was exposed, the size of the resection defect was estimated. A malleable template was molded to fit the anticipated defect, then used to design the AO plate. Four bicortical screw holes were drilled on both sides of the anticipated resection margins before resecting the mandibular segment. After the resection, a flap was transferred into position before attaching the AO plate.

RESULTS

Four of nine free flap patients (44%) had successful reconstruction; scapular 2 of 4 (50%), fibular 1 of 3 (33%) and redial forearm 1 of 2 (50%). (Table 3).

One of the two successful osteocutaneous scapular free flaps, the free skin flap was planned to reconstruct the floor of the mouth. It was too thick, a STSG was used instead. The other had 2 skin paddles for a through-and-through cheek defect.

The patient with successful osteocutaneous fibular free flap, miniplates were utilized. He had malocclusion. After irradiation, he tried to mold the mandible by himself. The mucosa was torn and osteitis developed. Some part of the infected bone was removed and a sternocleidomastoid myocutaneous flap was transferred to the defect.

Table 1. Tumor characteristics.

Tumor site	Free flap	AO plate
Floor of the mouth	3	1
Alveolar ridge	2	2
Retromolar trigone	2	-
Buccal mucosa	1	1
Tongue	1	-

Table 2. Clinical stage.

	Free flap	AO plate
Stage III	3	1
Stage IV	6	3

Table 3. Success of free flap.

Free flap	Success	Total
Scapular	2	4
Fibular	1	3
Radial forearm	1	2
	4	9

Table 4. Success of plating.

AO plate	Soft tissue reconstruction	Results
1	Primary closure	Success
2	Advancement tongue flap	Success
3	Radial forearm free flap	Removed 8 mth.
4	Advancement tongue flap	Removed 15 mth.

Table 5. Clinical outcome.

Survivor (5)	Free flap (3)	AO plate (2)
Stage III (2)	Buccal mucosa (1)	Floor of mouth (1)
Stage IV (3)	Floor of mouth (2)	Alveolar ridge (1)

Only seven of nine cases of free flap patients received postoperative irradiation. This was because two failed cases of scapular and fibular free flaps refused further treatment.

Two of four cases (50%) of AO plate reconstruction were successful. Both of them had a lateral defect, one was reconstructed by an AO plate and primary closure, the other was reconstructed by an AO plate combined with an advancement tongue flap.

In AO plate failure group, one had anterior defect reconstructed by an AO plate and a radial forearm free flap. Two weeks after the operation, there was infection from dental root at the osteotomy site. Tooth extraction and abscess drainage were performed. After that the patient was able to wear a dental prosthesis. Eight months postoperation, the plate was removed due to recurrent infection.

Another plate failure was a lateral defect. We used an advancement tongue flap combined with the plate reconstruction. Fifteen months after the operation, the plate extruded at the thin cheek flap resulting from cancer removal (Table 4).

All four cases of AO plate received postoperative irradiation. The average operating time of free flap was about 10 hours and that of AO plate was about 8 hours.

The patients were followed until June 1995. The follow-up period was 1-66 months (average 21.3 months). Five patients from 13 cases are alive (38.5%). There were stage III 2 cases and stage IV 3 cases. Reconstruction by a free flap 3 cases and an AO plate 2 cases (Table 5).

DISCUSSION

Free tissue transfer of vascularized bone has revolutionized mandibular reconstruction. In free flap reconstructive surgery there should be two surgical teams; one for cancer destruction and another for flap harvesting and microvascular anastomosis. This might result in a greater than 85 per cent[8] success rate. If only one team has to perform the whole operation, the success rate will be low. In the first seven cases of free flap, the whole operation was performed by one team and only two cases succeeded.

In a free flap mandibular reconstruction, a combination with an AO plate maintains a better jaw contour and better occlusal relationships of residual teeth, and allow for the transmission of stronger masticatory forces between segments. Patients could be equipped with osseointegrated implants and rehabilitated with dental implant loaded prosthesis and recovered a normal masticatory function as much as 76 per cent[9].

In AO plate reconstruction, some surgeons use an intermaxillary fixation or a fixation bar that helps maintain the position of the mandibular segments when applying the plate[6]. There were some reports using the titanium hollow screw osseointegrating reconstruction plate with better results than the AO plate made from stainless steel[6,10]. There could be complications with plate reconstruction including wound dehiscence, fistula, plate exposure, flap loss, loosening of the plate, plate fracture and malocclusion.

Schusterman reported a success rate for use of the AO plate was 15 of 20 cases (75%). There were six anterior reconstructions, of which only 2 (33%) were successful. This was opposed to

13 of 14 (93%) lateral reconstructions that were successful[11]. Gullane suggested a lingual application of the plate in reconstruction anterior defects reduced the risk of flap dehiscence, ulceration and necrosis[6]. Our patient with an anterior reconstruction, the plate failure resulted from recurrent dental root infection. Another plate failure patient had a lateral reconstruction combined with an advancement tongue flap. The tumor resection resulted in a thin cheek flap so that the plate eroded the cheek flap and extruded.

Gullane reported that four of the sixty-four plate patients were wearing a dental plate[6]. One patient of this report could wear a dental prosthesis before the plate was removed at the eighth month postoperatively.

Approximately 90 per cent of recurrence ocurred within 2 years after treatment. Five-year survival rate for stage III was 25-35 per cent and stage IV was 7-20 per cent[12]. Five of thirteen patients (38.5%) survived, followed-up until June 1995. The range of follow-up period was 24-66 months (average 41.4 months)

Because of the low survival rate, the treatment should be aggressive. The AO plate reconstruction had less immediate failure. Our patients with plate reconstruction failed at eight and fifteen months postoperatively so that all plate patients received postoperative irradiation. But two failed free flap refused further treatment. Koch recommended using alloplastic devices for reconstruction in patients with poor prognosis, very short mandibular segment or no appropriate vascular pedicle for microvascular anastomosis[10].

SUMMARY

At the present time the vascularized bone graft is the best procedure for reconstruction of mandibular defects. Reconstruction with AO plate is simpler and requires less operating time than with free flap. It can combine with regional flap or primary closure with no associated donor-site morbidity. The patient can receive postoperative irradiation safely. Boyd recommended plate reconstruction only in lateral defects in patients with a poor prognosis[13].

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การซ่อมแซมกระดูกขากรรไกร : Free flap และ AO plate

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การศึกษานี้มีจุดประสงค์ที่จะเปรียบเทียบการใช้ AO plate และ free vascularized bone graft ในการซ่อมแซมกระดูกขากรรไกร ตั้งแต่เดือนเมษายน 2532 จนถึงเดือนธันวาคม 2536 คณะผู้วิจัยได้ผ่าตัดซ่อมแซมกระดูกขากรรไกร 13 ราย โดยใช้ AO plate 4 ราย และ free flap 9 ราย ในการใช้ AO plate ได้ผลดี 2 ใน 4 ราย (50%) ผู้ป่วยที่ใช้ AO plate รายหนึ่งที่ได้ผลไม่ดี ต้องเอา plate ออกหลังผ่าตัดได้ 8 เดือน ผู้ป่วยรายนี้สามารถใส่ฟันปลอมได้ ผู้ป่วย free flap 7 รายแรก นั้น การผ่าตัดรักษามะเร็งและการทำ microvascular anastomosis ทำโดยแพทย์ชุดเดียว ผู้ป่วย free flap ได้ผลดี 4 ราย (44%) การใช้ AO plate พร้อม flap. สำหรับซ่อมแซม mandible ส่วนด้านข้างค่อนข้างปลอดภัย, ง่าย, ได้ผลดี, เสียเวลาน้อยกว่า, ได้รูปร่างที่ดี และสามารถฉายรังสีหลังผ่าตัดได้อย่างปลอดภัย การทำ free flap ได้ผลดี ถ้ามีแพทย์ 2 ชุด โดยชุดหนึ่งผ่าตัดรักษามะเร็ง และอีกชุดทำ free flap ผลในระยะยาวของ free flap ดีกว่า AO plate

คำสำคัญ : การซ่อมแซมกระดูกขากรรไกร, แฟลบอิสสระ, เอโอเพลท

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