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第17回　日本耳科学会総会・学術講演会のお知らせ

第17回日本耳科学会総会・学術講演会を以下のとおり開催いたします。演題登録には日本耳科学会への事前の入会が必要です。多数の先生方のご参加をお待ち申し上げます。

記

会　期：2007年10月18日（木）～20日（土）

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会場整理費：18,000円（懇親会無料）

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Jonathan Ashmore（University College London）

教育講演：耳科領域でのコンピュータ外科手術の応用と展望

シンポジウム：聴覚中枢におけるバイオメカニクス

パネルディスカッション：聴神経腫瘍

臨床セミナー（2題），ランチョンセミナー（6題），一般演題等を予定

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第17回日本耳科学会総会・学術講演会会長　小宗静男

Scand J Plast Reconstr Surg Hand Surg, 2007; 41: 14–21

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healthcare

ORIGINAL ARTICLE

Reconstruction of maxillectomy defects with free flaps - comparison of immediate and delayed reconstruction: A retrospective analysis of 51 cases

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Abstract

To establish a standard reconstructive material we compared outcomes after immediate and delayed reconstruction. Of the 21 patients who had immediate reconstruction, six patients had upper horizontal plane reconstruction. All bone grafts survived without infection or absorption. Of the 30 patients who had delayed reconstruction, 22 patients had upper horizontal plane reconstruction, with vascularised bone in 14 patients, non-vascularised bone or cartilage in five patients, and hydroxyapatite bone block in three. Postoperative infections developed in three of four patients for whom costal cartilage was used, and in all three patients for whom hydroxyapatite blocks were used. Non-vascularised bone or cartilage grafts are preferable for immediate reconstruction because of their technical simplicity. Vascularised bone grafts or osteocutaneous flaps are preferable for delayed reconstruction, however, as in most cases the operating field is contaminated by bacterial.

Key Words: *Maxilla, reconstruction, microsurgery, free flap, free bone, vascularized bone*

Introduction

Restoration of composite tissue defects after maxillectomy remains a difficult problem, as various adjacent structures such as the paranasal sinuses, palate, nasal cavity, orbital contents, skull base, oral mucosa, and cheek skin are often excised together with the maxillary bone. The timing of reconstruction is also difficult, and remains controversial. Some oncologists recommend avoiding immediate reconstruction after ablative excision of maxillary cancer to facilitate inspection for recurrent tumour, although there are numerous ways to monitor this nowadays. Reconstruction has also been recommended, as this allows enough of the maxilla and surrounding affected tissues to be removed, so increasing the range of indications for maxillectomy as a curative treatment [1]. The timing and need for reconstruction remain contentious issues among oncologists, while there has been little discussion among reconstructive surgeons. Various opinions have been put forward about optimal reconstructive materials and procedures for the midface, and standard methods of reconstruction have not yet been established.

We present a retrospective analysis of 51 patients who had either immediate ($n=21$) or delayed ($n=30$) reconstruction after maxillectomy using free flaps.

Patients and methods

Patients

Between 1993 and 2004, a total of 51 patients (36 men, 15 women) had maxillary and midfacial reconstruction at the University of Tokyo Hospital (1993–2002) and Kyorin University Hospital (2003–2004). Patients who required maxillectomy mainly had maxillary cancer, with the exception of

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one with osteosarcoma of the maxilla and one patient with adenocarcinoma of the lacrimal gland. Mean age at operation was 56 years (range 20 to 74). Twenty-one had immediate (primary) reconstruction after resection, and 30 patients had delayed (secondary) reconstruction after a follow-up period.

Types of reconstruction

The flaps used are shown in Table I. Radial vessels or dorsalis pedis were grafted between pedicles of the transferred flaps and recipient vessels when recipient vessels were too far away from the pedicle vessels of the transferred flap.

Reconstruction of bony support

The midface and orbits are described as a structural unit [2,3]. We also simplified the maxilla as follows (Figure 1). The three vertical buttresses of the maxilla include the nasofrontal, zygomatic, and pterygomaxillary buttresses. The two horizontal planes include the lower horizontal plane, chiefly consisting of the palatal bone and maxillary alveolus, and the upper horizontal plane, comprising the orbital floor and zygomatic arch. In this series, vascularised bones, non-vascularised bones or cartilages, and hydroxyapatite blocks were used to reconstruct the upper horizontal plane.

Results

Failure of flaps

Following immediate reconstruction, arterial thrombosis was seen in one patient, and prompt exploration and reanastomosis resulted in successful salvage of the flap. Flap transfer was successful in all cases when used for immediate reconstruction. With delayed reconstruction, however, arteries thrombosed in three patients and veins in three patients.

Table I. Material used in immediate and delayed reconstruction.

Reconstructive material	Number of patients	
	Immediate ($n=21$)	Delayed ($n=30$)
Rectus abdominis musculocutaneous flap	16	12
Scapular osteocutaneous flap	2	10
Latissimus dorsi-serratus anterior muscle rib osteomyocutaneous flap	2	0
Latissimus dorsi musculocutaneous flap	1	0
Radial forearm osteocutaneous flap	0	3
Anterolateral thigh flap	0	3
Fibular osteocutaneous flap	0	1
Radial forearm flap	0	1

Although we tried to salvage three flaps by vascular reanastomosis, the flap necrosed completely. All three necrosed flaps required interpositional vessel grafts or a forearm flap as an interpositional flap, as the pedicles could not reach the recipient vessels. The success rate with delayed reconstruction was therefore 90%.

Reconstruction of the upper horizontal plane

Table II shows the results of reconstruction of the upper horizontal plane, comprising the orbital floor and zygomatic prominence. Of 21 patients who had immediate reconstruction, bones comprising the upper horizontal plane including the Lockwood ligament were excised in 18. Of these 18, six reconstructions used vascularised bone (scapula and rib, $n=2$ each) or non-vascularised costal cartilage ($n=2$). All bone grafts survived without infection or absorption.

Of 30 patients whose reconstruction was delayed, the upper horizontal plane including the Lockwood ligament was lost in 26 patients. Of these 26 patients, 22 reconstructions involved vascularised bone (scapula, $n=10$; radius, $n=3$; fibula, $n=1$), non-vascularised bone, or cartilage (costal cartilage, $n=4$; cranium, $n=1$) or hydroxyapatite block ($n=3$). Postoperative infection developed in three of four patients in whom costal cartilage was used, and in all three patients who had a hydroxyapatite block. Materials used for reconstruction were resected in all six patients with postoperative infection.

Reconstruction of the eye socket

The eye was excised or enucleated in 16 patients who had immediate reconstruction, and it had already been done in six patients who had delayed reconstruction. With immediate reconstruction, three patients underwent simultaneous reconstruction of the eye socket using a skin portion of the scapular osteocutaneous flap ($n=2$) or rectus abdominis musculocutaneous flap ($n=1$). The eye socket was not reconstructed in the other 13 patients. With delayed reconstruction, two of the six had their eye sockets reconstructed using rectus abdominis musculocutaneous flaps.

Reconstruction of the base of skull

The anterior base of the skull was resected in eight patients. All patients had immediate reconstruction using rectus abdominis musculocutaneous flaps to seal the brain from the nasoethmoidal space and prevent infection.

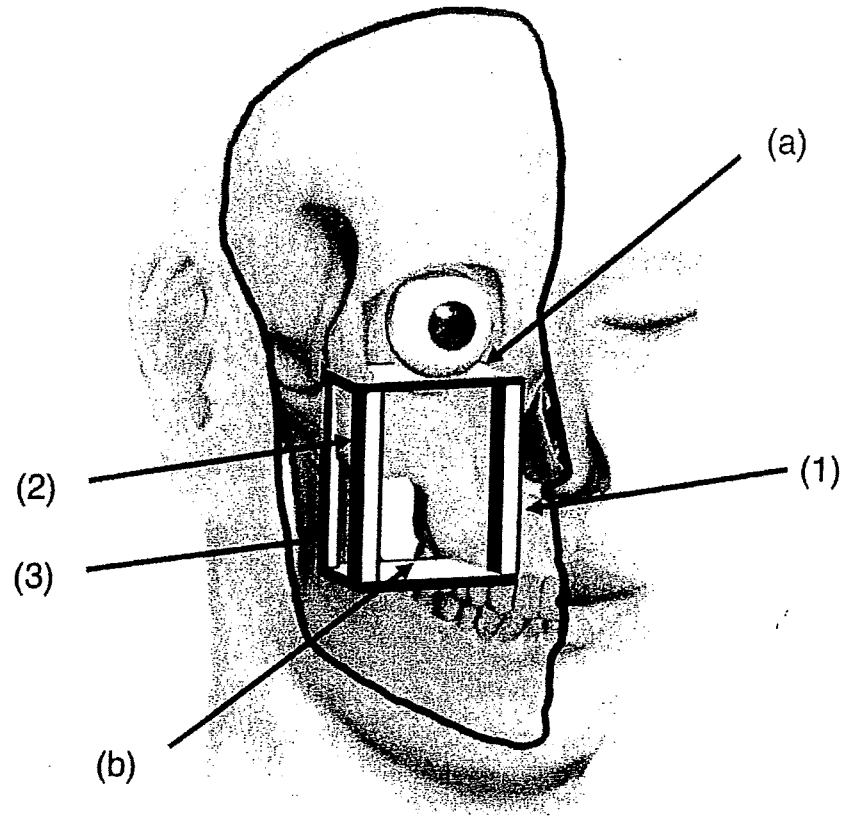

Figure 1. Diagram of the midface. The three vertical buttresses of the maxilla include the nasofrontal (1), zygomatic (2), and pterygomaxillary (3) buttresses. The two horizontal planes include the upper horizontal plane (a) consisting of the orbital floor and zygomatic arch, and the lower horizontal plane (b) chiefly consisting of the palatal bone and maxillary alveolus.

Case reports

Case 1

A 51-year-old man presented with squamous cell carcinoma of the left maxillary sinus. After 30 Gy of preoperative radiotherapy, and chemotherapy using 5-fluorouracil and cisdatin, the maxilla including the upper and lower horizontal planes was resected en bloc, preserving the orbital contents, together with a radical neck dissection. The upper horizontal plane was reconstructed using non-vascularised eighth and ninth costal cartilages, which were fabricated and fixed to the remaining frontozygomatic process and zygomatic arch with titanium miniplates. A rectus abdominis musculocutaneous flap with two cutaneous islands was used for reconstruction of the palate and nasal lining. His postoperative course was uneventful, with no infection or exposure of cartilages. Four years postoperatively, the position of his eyes is symmetrical, and he has no double vision, but the left cheek is slightly depressed (Figure 2).

Table II. Success rate of bone and cartilage grafts for reconstruction of the orbital floor. Data are number of patients.

	Number of patients who survived	
Material used for reconstruction	Immediate ($n=6$)	Delayed ($n=22$)
Vascularised bone	4	14
Non-vascularised bone and cartilage	2	5
Implant	0	3

Case 2

A 66-year-old woman presented with severe facial deformity and double vision caused by downward dislocation of the left eye after resection of squamous cell carcinoma of the left maxillary sinus. As the palate was not resected and the soft tissue defect was small, a 4×2 cm piece of calvarial bone was used to reconstruct the orbital floor and restore the position of the eye. An anterolateral thigh flap was used to cover the transferred calvarial bone and to reconstruct the facial skin defect created in the lower lid region by repositioning the slipped eyeball to avoid ectropion. One year postoperatively, her double vision has vanished, and her facial contours are improved (Figure 3). The anterior thigh skin gave a poor colour match to the cheek, and was later replaced with a skin graft from the preauricular skin.

Figure 2. Case 1. (*a*) Preoperative computed tomogram. (*b*) Immediately after the en bloc excision using the Weber-Fergusson approach. (*c*) The rectus abdominis musculocutaneous flap was set in the defect to create the oral and nasal lining. (*d*) The non-vascularised rib cartilage (→) was fabricated and fixed to the remaining frontozygomatic process and zygomatic arch with titanium miniplates. (*e*) Postoperative appearance at four years. (Published with the patient's consent). (*f*) Postoperative computed tomogram at four years.

Case 3

A 27-year-old man had a spindle cell sarcoma of the left maxilla resected. After a period of three years he complained of double vision and oronasal incompetence as a result of the resection of the palate. Because the defective maxilla with its bacterial contamination had to be removed for palatal closure, vascularised scapula was used for the reconstruction of the upper horizontal plane and a scapular flap was used for obliteration of the maxilla. Three years postoperatively the patient can speak well and eat without dentures, although the alar base is slightly depressed (Figure 4).

Discussion

The midface contains highly specialised structures that serve multiple functions confined within a small space, and is therefore exceedingly complicated. Reconstruction of defects is a challenge to reconstructive surgeons. Microvascular tissue transfer has dramatically changed the way we reconstruct the head and neck, and also forms the mainstay for reconstruction after maxillectomy. However, there are various opinions about which materials and methods are best for the midface. Some reconstructive surgeons have recently advocated that midfacial skeletal reconstruction after resection should be

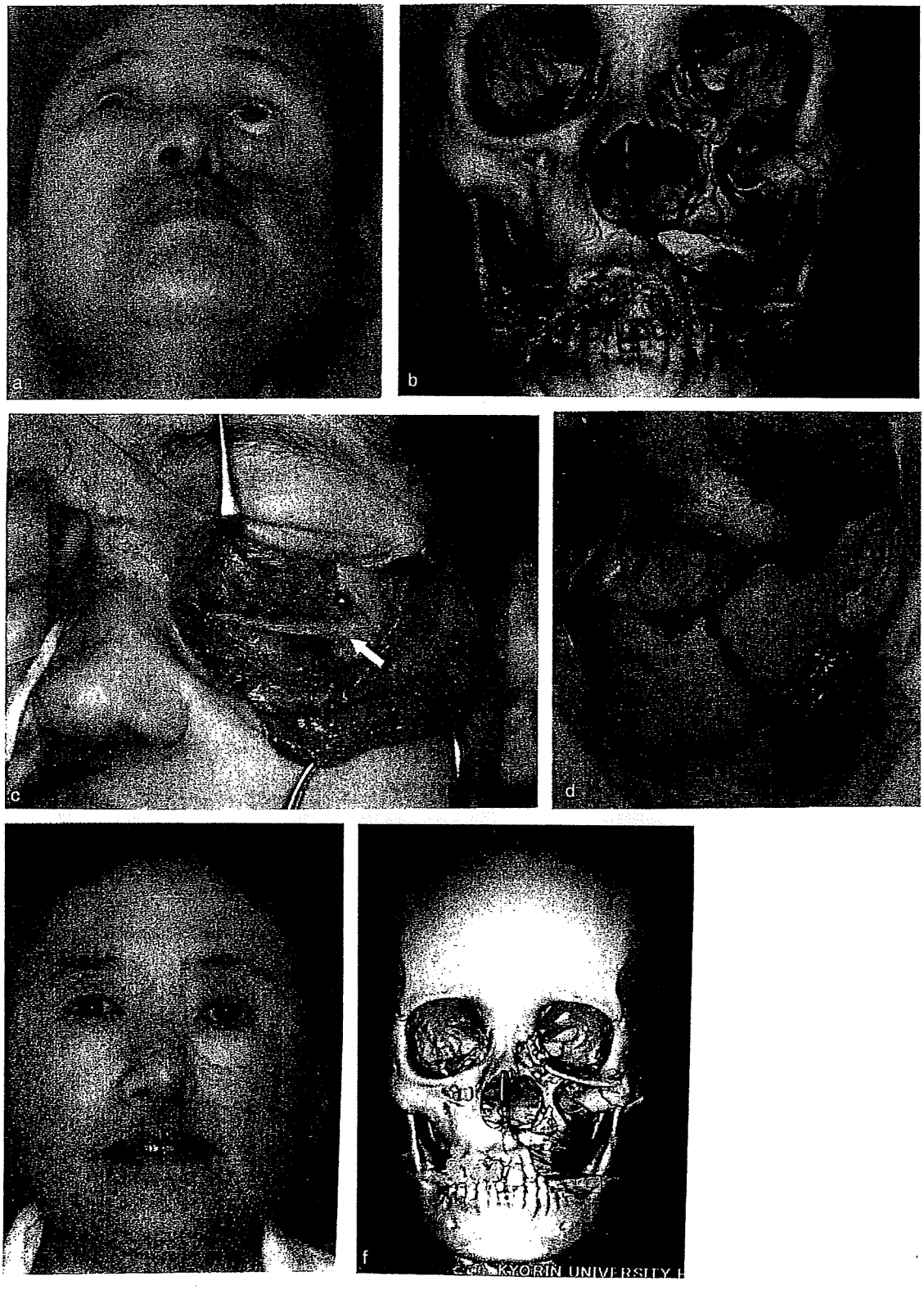

Figure 3. Case 2. (*a*) Preoperative appearance. (Published with the patient's consent). (*b*) Preoperative three-dimensional computed tomogram. (*c*) Calvarial bone (→) was used to restore the position of the eyeball. (*d*) An anterolateral thigh flap was used to cover the transferred calvarial bone and to reconstruct the facial skin defect. (*e*) Postoperative appearance at one year. (Published with the patient's consent). (*f*) Postoperative three-dimensional computed tomogram at one year.

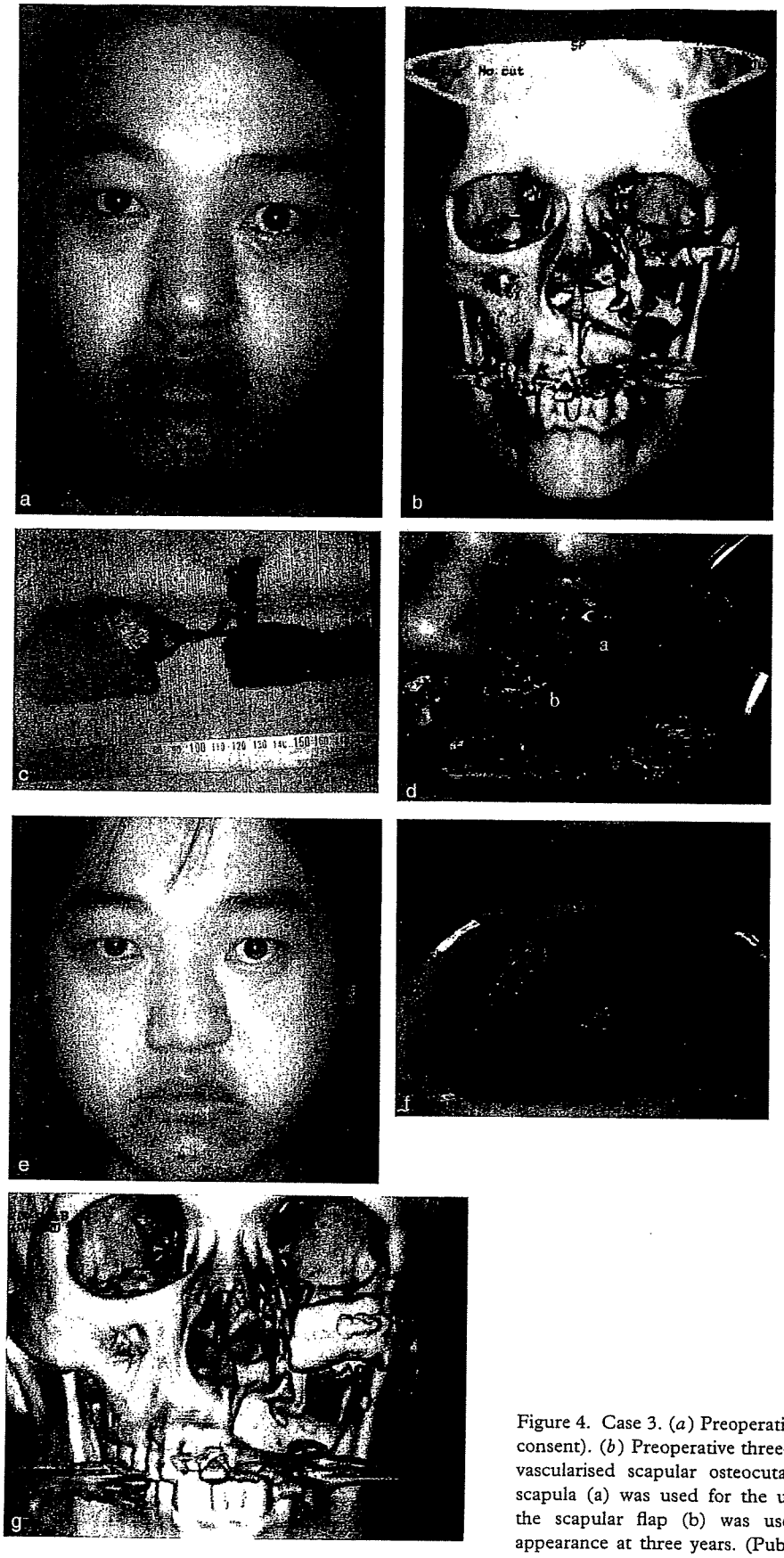

Figure 4. Case 3. (*a*) Preoperative appearance. (Published with the patient's consent). (*b*) Preoperative three-dimensional computed tomogram. (*c*) The vascularised scapular osteocutaneous flap that was harvested. (*d*) The scapula (a) was used for the upper horizontal plane reconstruction, and the scapular flap (b) was used for palatal closure. (*e*) Postoperative appearance at three years. (Published with the patient's consent). (*f*) The palate closed by the scapula flap. (*g*) Postoperative three-dimensional computed tomogram at three years.

based on the principles of the restoration of maxillary buttresses [3,4]. The concept of maxillary buttresses was originally described by Sicher and DeBrul [5] and re-emphasised by Manson et al. [6] and Gruss and Mackinnon [7] in the treatment of Le Fort-type facial fractures. The three maxillary buttresses are the medial buttress (nasomaxillary buttress), the lateral buttress (zygomaticomaxillary buttress) and the posterior buttress (pterygomaxillary buttress). According to Gruss and Mackinnon [7], reconstruction of the anterior (medial and lateral) buttresses is important for exact vertical height and horizontal projection of the maxilla. These concepts attach great importance to vertical skeletal supports and simplify the treatment of complicated facial bone fractures. These concepts are absolutely true in the treatment of the Le Fort-type fracture in which the midface is often shortened vertically.

In reconstruction of the maxilla after tumour ablation, however, vertical reconstruction is rarely required because posterior components of the midface such as posterior wall of the maxillary sinus and pterygomaxillary buttress almost always remain. Vertical height of the maxilla is rarely shortened after maxillectomy, even in total maxillectomy. Conversely, horizontal planes such as the orbital floor (upper horizontal plane) and palate (lower horizontal plane) are often resected. Coleman therefore proposed an alternative concept for maxillary reconstruction after tumour ablation, in which midfacial bones are simplified into a truncated pyramidal shape and functional surfaces of the midface buttress include the infraorbital area, palate, lateral nasal wall, and buccal-malar skin [2]. Coleman noted that reconstruction of the entire structure is usually impractical and satisfactory reconstruction can be performed by obliterating the central cavity and replacing the important surfaces (orbital, palatal, and malar) using vascularised bone and soft tissue flaps.

Our concept of the maxillary structure is shown in Figure 1. The three vertical buttresses of the maxilla including the nasofrontal, zygomatic, and pterygomaxillary buttresses, maintain midfacial projection and vertical height. The concept of buttresses means vertical supports, so buttresses primarily comprising orbital and palatal bones should be named horizontal planes rather than buttresses, to avoid confusion in terminology. Of the two horizontal planes, the lower horizontal plane consists mainly of palatal bone and maxillary alveolus, and provides a normal occlusal plane for the mandible. This also maintains facial width and proportion in close connection with the vertical buttresses. The upper horizontal plane, consisting of the orbital floor and zygomatic arch, supports the eyes and forms the zygomatic prominence, which is also aesthetically important in manifesting three-dimensional form of the face.

Maxillary reconstruction should be planned according to these anatomical characteristics. We think that reconstruction of all three vertical buttresses is unnecessary, because the posterior wall of the maxilla is almost always left intact after resection, which is a distinct difference from a Le Fort-type fracture. As a result, the vertical height of the maxilla can be retained without reconstruction. Bony reconstruction of the nasofrontal vertical buttress is clearly important to avoid depression of the alar base. The pterygomaxillary buttress and lower horizontal plane are likewise important for osseointegration. However, reconstruction of this buttress and plane using a vascularised bone transfer is difficult, and these problems can be resolved simply using maxillary prostheses [8]. A depressed alar base can be raised by dentures, with only reconstruction of the medial nasal wall with a soft tissue flap. Osseointegration is hardly required for patients with maxillary cancer, who typically have a poor prognosis. The zygomatic buttress, while certainly important for malar prominence, can be achieved by reconstruction of the upper horizontal plane. On the other hand, reconstruction of the upper and lower horizontal planes is more important than that of the vertical buttresses. Restoration of downward deviation of the orbit because of loss of the upper horizontal plane is critical for the treatment of double vision and facial aesthetics. Although many surgeons admit that the upper horizontal plane (orbital floor) should be reconstructed using hard tissue, some have suggested that vascularised bone should be used to avoid infection or absorption of transferred bone [4,9,10], while others have reported the safety of a non-vascularised bone graft [3,11]. We think that one of the reasons underlying such confusion lies in differences of the timing of reconstruction. One of the aims of the present paper was therefore to elucidate differences in results between immediate and delayed reconstructions.

For immediate reconstruction we used either a rectus abdominis or a latissimus dorsi musculocutaneous flap, which is rather large. In all six patients who had their upper horizontal planes reconstructed, the grafted bone survived well. This is probably because non-vascularised costal cartilage could be adequately wrapped with a large flap. However, various types of flaps with little soft tissue such as radial forearm and anterolateral thigh flaps were used for delayed reconstruction. Postoperative infection occurred in three of four patients in whom a non-vascularised costal cartilage had been used, although vascularised bone that avoided necrosis of

the flap survived well in all patients. These results indicate a greater possibility of infection if non-vascularised bone cannot be wrapped adequately in a large soft-tissue flap.

Another reason for the high infection rate in non-vascularised bone with delayed reconstruction may be that the operative field is inevitably contaminated by bacterial flora that has already become established in the maxillary defect. Vascularised bone should be selected for reconstruction of the upper horizontal plane for delayed reconstruction, but bacterial contamination of the operative field can be avoided in delayed reconstruction if the maxillary defect is left untouched without reconstruction of the nasal wall or palate. The upper horizontal plane should be reconstructed using only non-vascularised bone together with a soft-tissue free flap. The only patient in whom non-vascularised bone was successfully transferred during delayed reconstruction had such a manipulation.

In addition to the upper horizontal plane, the lower horizontal plane is critical for oronasal competence. Palatal closure is advisable, as patients can usually speak well and eat without dentures [3]. However, palatal closure may reduce prosthetic stability [8], so we think that palatal defects should be closed in younger patients with sufficient residual maxillary teeth for chewing, and an obturator should be used without palatal closure for elderly patients with few residual teeth. Combining the reconstructive concepts of upper and lower horizontal planes, reconstruction should be planned as follows: for immediate reconstruction, the upper horizontal plane should be reconstructed using non-vascularised free bone. Vascularised bone should be used for delayed reconstruction when the nasal or palatal walls are reconstructed and bacterial contamination is expected. This is particularly so when patients are young and with sufficient residual teeth and dentures are not required. However, non-vascularised bone should be used when the maxillary defect has not been touched during operation. When the palate is open dentures are obviously required postoperatively.

For immediate reconstruction all transfers were successful, although there was one arterial thrombosis which was treated by immediate reanastomosis. For delayed reconstruction, however, transferred flaps resulted in necrosis in three of 30 patients. All three necrosed flaps had required interpositional vessel grafting or a radial forearm flap as an interpositional flap, as flap pedicles could not reach the recipient vessels. However, the use of serial flaps is reportedly safe [12,13], even though the risk of necrosis may be higher because double the number of microanastomoses are required. We therefore cannot conclude that the high rate of necrosis in delayed reconstruction results from the use of serial flaps. Another common factor in necrosed flaps was arterial thrombosis, which occurred around postoperative day 4 (relatively late postoperatively) in all cases. The nasal cavity or palate was closed during the operation in each of these three cases. Bacterial contamination is inevitable when the maxillary defect is completely closed, so we think that the cause of the high rate of necrosis of flaps in delayed reconstruction compared with immediate reconstruction involves infection around the pedicles that leads to late vascular thrombosis. To avoid this type of infection, the maxillary defect should be cleaned preoperatively.

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Free Jejunal Transfer for Patients With a History of Esophagectomy and Gastric Pull-Up

Hirotaka Suga, MD, Mutsumi Okazaki, MD, Shunji Sarukawa, MD, Akihiko Takushima, MD, and Hirotaka Asato, MD

Abstract: Some patients who undergo pharyngolaryngoesophagectomy with free jejunal transfer reconstruction have a history of esophagectomy and gastric pull-up. We retrospectively reviewed a series of 12 patients to examine the characteristic problems in free jejunal transfer for patients with a history of esophagectomy and gastric pull-up. There was no postoperative thrombosis. No anastomotic leakage or fistula was found. Five of 12 patients presented postoperatively with dysphagia. Two of the 5 patients showed stricture at the distal anastomosis. Three of the 5 patients showed no stricture. However, their reconstructed tracts were tortuous around the distal anastomosis, which could be a cause of dysphagia. Even in patients with a history of esophagectomy and gastric pull-up, free jejunal transfer can be performed safely, although the functional outcome of swallowing is not always satisfactory.

Key Words: free jejunal transfer, history of esophagectomy, dysphagia

(*Ann Plast Surg* 2007;58: 182–185)

It is well known that patients with cancer of the head and neck have a high incidence of multiple primary cancers.[1,2] Some patients who undergo pharyngolaryngoesophagectomy with free jejunal transfer reconstruction have a history of esophagectomy and gastric pull-up. We hypothesized that not only tumor resection but also reconstruction would be difficult in such patients. In this study, we examined the characteristic problems in free jejunal transfer for patients with a history of esophagectomy and gastric pull-up.

PATIENTS AND METHODS

From 1995 through 2004, 112 patients underwent pharyngolaryngoesophagectomy with free jejunal transfer reconstruction at the University of Tokyo Hospital. Of these patients, 12 had a history of esophagectomy and gastric pull-up (Table 1). All of the 12 patients were males. The average age was 67 years (range, 45 to 82 years). The average interval between esophagectomy and free jejunal transfer was 7.5 years (range, 2 to 16 years). Nine of the 12 patients had received radiation therapy preoperatively. We retrospectively reviewed this series of 12 patients, focusing on the postoperative complications and functional results. The average follow-up was 12 months (range, 2 to 25 months).

RESULTS

In all 12 patients with a history of esophagectomy and gastric pull-up, a free jejunal graft could be harvested in the usual manner.

For recipient arteries, the superior thyroid artery was used in an end-to-end fashion in 6 patients and the transverse cervical artery in 6 patients. For recipient veins, the internal jugular vein was used in an end-to-side fashion in all 12 patients. There was no postoperative thrombosis, and free jejunal transfer was successful in all 12 patients.

The pharyngojejunal anastomosis (proximal anastomosis) was performed in an end-to-end fashion in all 12 patients. The distal jejunal stump was anastomosed to the esophageal stump in 6 patients because part of the cervical esophagus was left after pharyngolaryngoesophagectomy (Fig. 1). In the other 6 patients, no esophagus was left, and the distal jejunal stump was anastomosed to the gastric tube, which had been pulled up in a previous surgery (Fig. 2). No anastomotic leakage or fistula was found postoperatively, although 2 patients developed minor wound infection.

Five of the 12 patients presented postoperatively with dysphagia. Video fluorography in 2 patients (1 patient had a jejunal graft anastomosed to the esophageal stump, 1 patient to the gastric tube) showed stricture at the distal anastomosis (Fig. 3). Three patients (2 patients had a jejunal graft anastomosed to the esophageal stump, 1 patient to the gastric tube) showed no stricture. However, their reconstructed tracts were tortuous around the distal anastomosis, which could be a cause of dysphagia (Fig. 4).

No perioperative death occurred in this study. During the follow-up period, 7 of the 12 patients died of their tumors.

In the other 100 patients without a history of esophagectomy and gastric pull-up, 3 patients had postoperative thrombosis, 6 patients presented with anastomotic leakage or fistula, and 15 patients suffered from dysphagia postoperatively.

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TABLE 1. Patient Data

Patient	Age/Sex	Interval, Year	Preoperative Radiation	Distal Anastomosis	Postoperative Thrombosis	Leakage or Fistula	Dysphagia	Follow-Up, Months
1	60/M	2	(−)	G	(−)	(−)	(+) a	9
2	80/M	6	(−)	E	(−)	(−)	(−)	9
3	74/M	16	60 Gy	G	(−)	(−)	(−)	2
4	82/M	10	86 Gy	G	(−)	(−)	(+) b	25
5	63/M	6	60 Gy	G	(−)	(−)	(−)	8
6	76/M	5	(−)	G	(−)	(−)	(−)	11
7	72/M	5	70 Gy	E	(−)	(−)	(+) b	6
8	67/M	12	60 Gy	G	(−)	(−)	(−)	14
9	45/M	2	50 Gy	E	(−)	(−)	(−)	8
10	65/M	12	Dose untraced	E	(−)	(−)	(+) a	24
11	55/M	2	72 Gy	E	(−)	(−)	(−)	14
12	61/M	12	Dose untraced	E	(−)	(−)	(+) b	11

a, stricture; b, tortuous tract; E, esophageal stump; G, gastric tube.

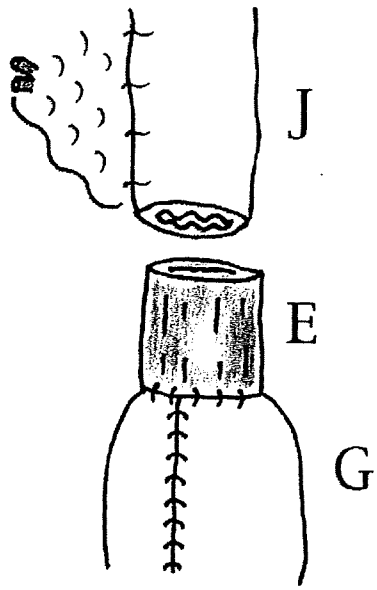

FIGURE 1. The distal jejunal stump is anastomosed to the esophageal stump. J, jejunal graft; E, esophagus; G, gastric tube.

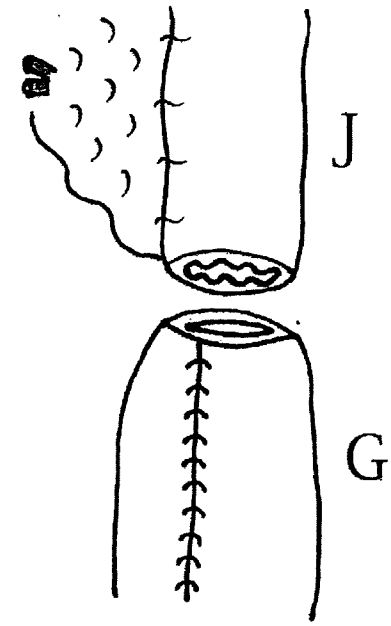

FIGURE 2. The distal jejunal stump is anastomosed directly to the gastric tube. J, jujunal graft; G, gastric tube.

DISCUSSION

Free jejunal transfer has become a standard and reliable procedure for pharyngoesophageal reconstruction. Some previous reports have indicated that this procedure is highly successful, with few postoperative complications.[3-6] At our institution, too, more than 100 free jejunal transfers have been performed during the past 10 years, most of which have been successful.

Patients with cancer of the head and neck have a high incidence of multiple primary cancers. In terms of another primary cancer in the same patient with cancer of the head and neck, esophageal cancer is the most common.[1,2] Gastric pull-up is a well-accepted procedure for esophageal reconstruction, although colon interposition or jejunal pull-up is used in cases where the stomach is unavailable.[7,8] Against this background, we sometimes perform free jejunal transfer for patients with a history of esophagectomy and gastric pull-up. This tendency is apparently increasing because of the advancing age of patients and improvements in the diagnosis and treatment of malignant tumors.[1,2]

Despite a history of esophagectomy and gastric pull-up, microvascular anastomosis was successful in all patients. Okazaki et al[9] have reported a high rate of arterial thrombosis (3 of 13 patients) in patients who have undergone free jejunal transfer as a salvage surgery after failed esophageal reconstruction. Nakatsuka et al[10] have also described that the flap survival rate in secondary reconstruction is significantly lower than that in immediate reconstruction. In the patients in

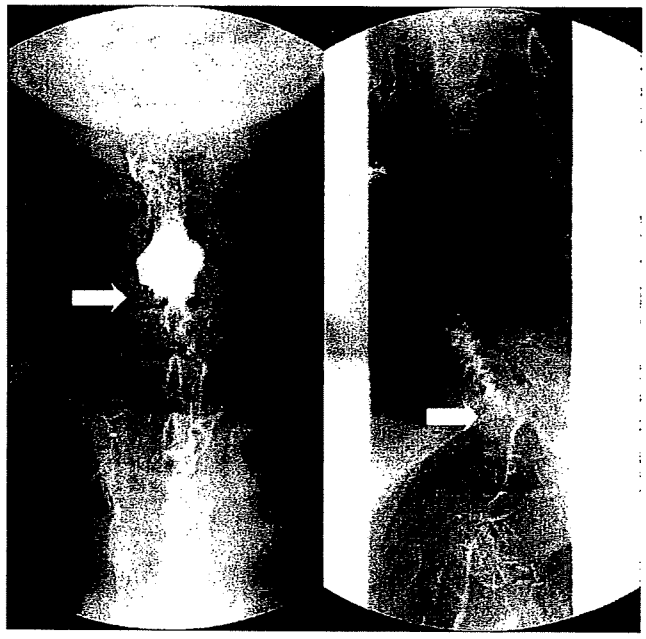

FIGURE 3. Postoperative video fluorography of patient 10. Arrows show stricture at the distal anastomosis.

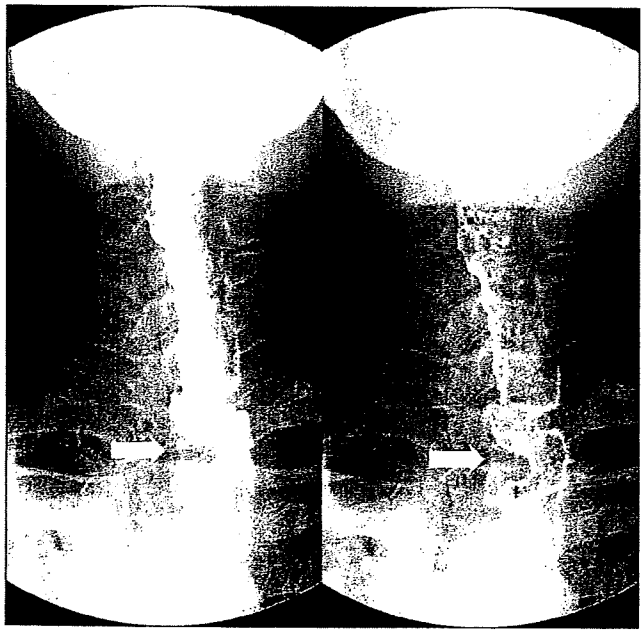

FIGURE 4. Postoperative video fluorography of patient 12. Arrows show a tortuous region around the distal anastomosis.

our study, the interval between esophagectomy and free jejunal transfer was relatively long (7.5 years). There was no active infection or inflammation. We believe that such good conditions reduced the risk of postoperative thrombosis.

Anastomotic leakage or fistula, especially in pharyngojejunal anastomosis, is a common complication in free jejunal transfer, occurring in 4% to 30% of cases.[3–6,11,12] A history of esophagectomy and gastric pull-up can increase the risk of this complication because of scar formation. A high rate of prior radiation therapy (9 of 12 patients in this study) may have an effect, as some authors have pointed out.[6,13] However, in this study, no anastomotic leakage or fistula was found postoperatively. We believe that a proper suture technique can decrease the rate of anastomotic leakage or fistula, even in patients with a history of esophagectomy and gastric pull-up.

The functional outcome of swallowing was not satisfactory in this study. Two patients presented with stricture at the distal anastomosis, which resulted in dysphagia. However, even in patients without a history of esophagectomy and gastric pull-up, stricture formation is a common complication, occurring in 4% to 30% of cases.[3–6,11,12] Thus, dysphagia caused by stricture does not appear to be characteristic in patients with a history of esophagectomy and gastric pull-up. Okazaki et al[14] have reported a new anastomotic technique, where jejunoesophageal anastomosis is performed after 2 longitudinal incisions are made at the corners of the esophageal stump. This provides a "Z-plasty-like" effect, which reduces the risk of delayed stricture formation. We did not try this technique in this series. However, we believe that this technique can also be applied in patients with a history of esophagectomy and gastric pull-up, where the distal jejunal stump is anastomosed either to the esophageal stump or the gastric tube.

Three patients showing no stricture presented with dysphagia. Their reconstructed tracts were tortuous around the distal anastomosis, which could be a cause of dysphagia. We believe that this type of dysphagia is characteristic in patients with a history of esophagectomy and gastric pull-up. It is likely that scar formation around the distal anastomosis, increased by a previous surgery and a prior radiation therapy, decreases the flexibility of the reconstructed tract and makes it tortuous rigidly. This phenomenon can occur more frequently in patients who have had a jejunal graft anastomosed to the esophageal stump than in those who have had a graft to the gastric tube. A small segment of the cervical esophagus, left after pharyngolaryngoesophagectomy, makes the structure of the reconstructed tract more complicated, and causes a tortuous tract. If possible, such a small segment should be resected, and a jejunal graft should be anastomosed directly to the gastric tube.

In conclusion, free jejunal transfer can be performed safely even in patients with a history of esophagectomy and gastric pull-up. However, the functional outcome of swallowing is not always satisfactory.

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ORIGINAL ARTICLE

Secondary reconstruction of the eye socket in a free flap transferred after complete excision of the orbit

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Abstract

Reconstruction of the eye socket in a free flap transferred after complete excision for malignancy is difficult. Between 1980 and 2005 we secondarily reconstructed five eye sockets in free flaps after resection of cancer, cirsoid haemangioma, and the consequences of irradiation for retinoblastoma. Free flaps were used during the primary operations to cover the defects. The eye socket was then reconstructed during the secondary operations with a conventional skin graft in two cases, and with a skin graft using the modified Antia's method in three cases. All free flaps survived and all eye sockets accepted ocular prostheses. Three patients in particular, whose eye sockets were reconstructed using the modified Antia's method, had excellent results. Here we describe operations and problems related to secondary reconstruction of eye sockets in previously transferred free flaps after complete excision, and describe some typical cases.

Key Words: *Eye socket reconstruction, malignant contracture, free flap*

Introduction

Surgical reconstruction of a contracted eye socket is a challenging problem for plastic surgeons. To correct a contracted eye socket, we may replace the orbital contents with a skin graft [1,2] or a mucosal graft [3,4], but the results are usually disappointing because of recurrence of the contracture resulting from poor vascularity of the graft bed [1]. Several methods of transferring pedicle flaps have been reported for reconstruction of eye sockets, and some of them may offer satisfactory reconstructive options [5–11]. However, when the tissue defect is extensive after complete excision, or the contracture is severe after heavy irradiation for retinoblastoma, such conventional methods cannot be used, and a free flap transfer would be recommended [12–15].

In 1993, Asato et al. [12] reported a series of 27 cases of reconstruction of the eye socket using a free flap transfer. They proposed four procedures, depending on the extent of the defect. Most of their cases had the eye enucleated, or incomplete excision, and their eyelids were retained. They could therefore reconstruct an eye socket by folding a free flap at the same time as the transfer. In patients who had complete excision, however, an eye socket cannot be reconstructed primarily with a free flap transfer, and should be reconstructed secondarily within the transferred free flap. We know of no reports that have described secondary reconstruction of an eye socket in a free flap other than that in the report by Asato et al. [12].

Between 1980 and 2005, we had five cases of secondary reconstruction of an eye socket in a previously transferred free flap. Here we report the operative techniques and postoperative problems of reconstructing an eye socket in a free flap.

Patients and methods

Patients

Between 1980 and 2005, we secondarily reconstructed the eye socket in a previously transferred

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Table I. Details of patients.

Case No.	Age (years)	Sex	Diagnosis	Flap	No. of revisions
1	51	M	Maxillary sinus carcinoma	LD+SA	3
2	44	M	Cirsoid haemangioma	LD	0
3	13	M	Retinoblastoma	DP	1
4	64	M	Squamous cell carcinoma of the palpebral skin	LD	0
5	77	M	Merkel cell carcinoma	RF	0

All sockets were reconstructed with skin grafts, case 2, 4, and 5 by the modified Antia's method.
LD = latissimus dorsi musculocutaneous flap, SA = serratus anterior musculocutaneous flap, DP = deltopectoral flap, RF = radial forearm flap.

free flap in five cases. Details of the patients are shown in Table I. All were men, and ranged in age from 13 to 77 years (mean 50) at the time of the free flap transfer. The diagnoses were recurrent maxillary sinus carcinoma invading the orbit, cirsoid haemangioma of the orbit and cheek, retinoblastoma, squamous cell carcinoma of the palpebral skin, and Merkel cell carcinoma of the lower eyelid (1 each).

In all cases, both eyelids and conjunctivae were lost, and a free flap transfer was required to cover the extensive full-thickness defect during the primary resection. There was a bony defect of the zygomaticomaxillary buttress in one case (case 1). Irradiation had been used in one case (case 3) for retinoblastoma in infancy. During the primary operation, a latissimus dorsi musculocutaneous flap was used in two cases, the latissimus dorsi and serratus anterior combined-musculocutaneous flap in one, the deltopectoral flap in one, and the radial forearm flap in one.

Method

Technique

Eye sockets were reconstructed secondarily with a conventional skin graft in two cases and with a skin graft based on the modified Antia's method [1] in three. Antia's method is an inlay skin grafting technique for reconstructing severely contracted eye sockets, which was originally described in 1984 [1]. We modified the procedure, and used it for reconstruction of eye sockets in a previously transferred free flap. The operation is done in 2 stages. During the primary operation a silicone or resin implant is draped with a split thickness skin graft and buried in a cavity made in the transferred flap through a transverse midline incision. The skin graft is folded, with its epithelial surface toward the implant. The implant should be considerably larger than the ultimate prosthesis. After six months or more, the implant is removed and the survival of the skin graft is confirmed. Suture of the lid margin is sufficient to reconstruct an eye socket, while an additional skin graft is added if necessary (Figure 1).

Results

All flaps survived. All patients could use an ocular prosthesis. After reconstructions, revision operations were required in two cases. Good shape and contour of the reconstructed eye sockets was obtained in all patients except case 1, in whom there was a large bony defect of the zygomaticomaxillary buttress without reconstruction. In particular, three cases whose eye sockets were reconstructed using a modified Antia's method had aesthetically excellent results, but the match of the colour and texture of the transferred flap with the surrounding skin was not satisfactory in all cases.

Case reports

Case 4

A 64-year-old man with a squamous cell carcinoma of his left upper palpebral skin had a radical resection of the tumour including complete excision of his left orbit (Figure 2*a*). The defect was immediately reconstructed with a free latissimus dorsi musculocutaneous flap transfer by anastomosis to the left superficial temporal vessels (Figure 2*b*).

At 20 months, a silicone implant draped with a split thickness skin graft taken from the groin was buried in the flap to reconstruct the eye socket. However, after the second operation, he did not return to our hospital.

At 5 years, he visited our hospital. The implant was removed and an additional split thickness skin graft was supplemented to reconstruct the eye socket. His left eyebrow was reconstructed simultaneously with a free hair-bearing scalp graft.

The reconstructed eye socket was wide enough, and the shape and contour of his left orbit were excellent, but the colour match of the flap was not satisfactory (Figure 2*c*, *d*).

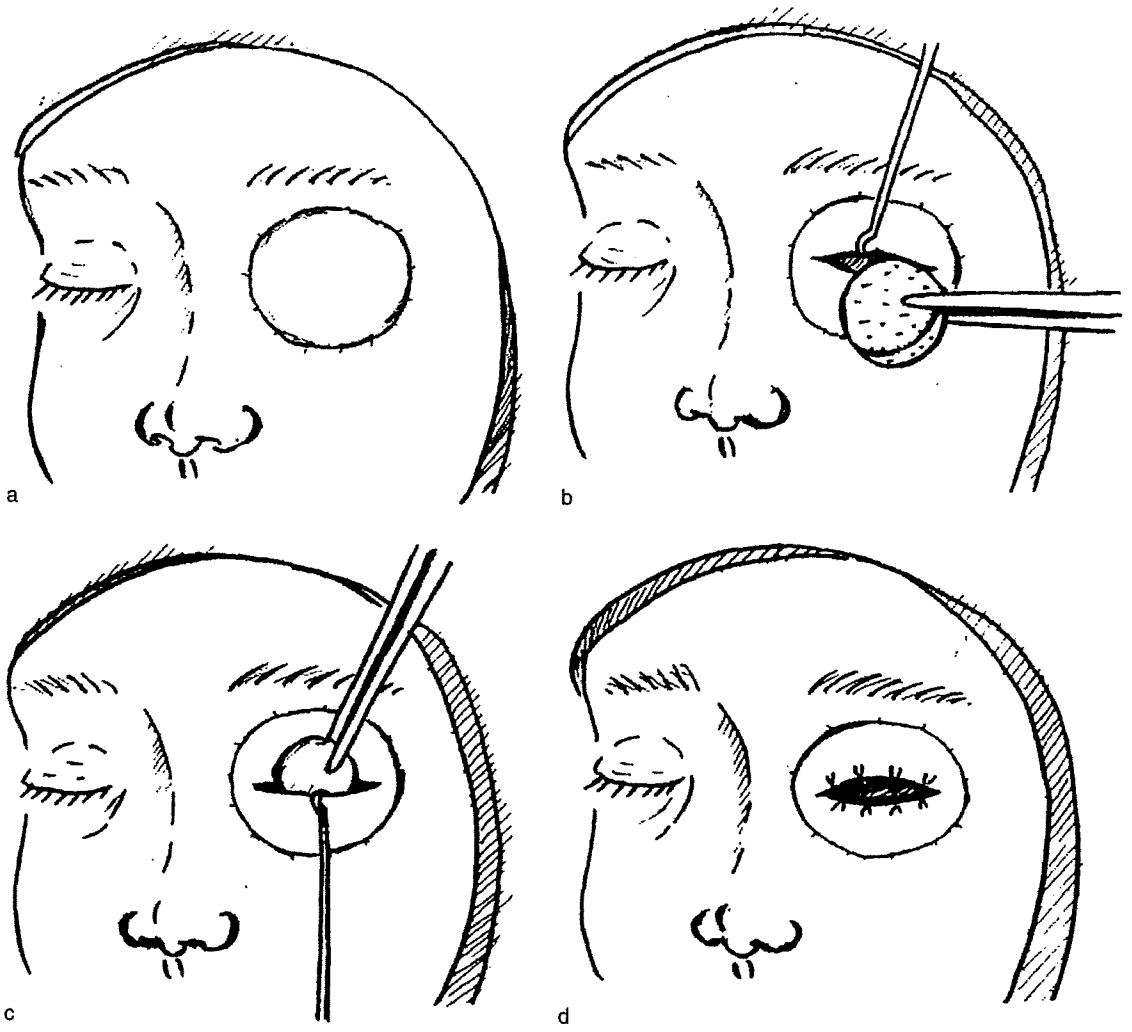

Figure 1. Diagram of the reconstruction of the eye socket based on the modified Antia's method. (*a*) Preoperative state. (*b*) During the first operation the implant, draped in a skin graft, is buried into the flap. (*c*) Six months or more later the implant is removed, and the survival of the skin graft is confirmed. (*d*) After removal of the implant.

Case 5

A 77-year-old man with a Merkel cell carcinoma of the right lower eyelid had a radical resection of the tumour including complete excision of his right orbit (Figure 3*a*). Immediately after resection of the tumour, a resin implant draped with a split thickness skin graft taken from lateral thigh region was buried in the orbit (Figure 3*b*), and a free radial forearm flap was subsequently transferred to cover the implant (Figure 3*c*). The right facial vessels were used as recipient vessels.

At 9 months, the resin implant was removed by incising the transferred flap, and the skin graft survived completely (Figure 3*d*). An eye socket was reconstructed with no need for an additional skin graft.

The shape and contour of his reconstructed eye socket were excellent, and the colour match of the flap was satisfactory (Figure 3*e*).

Discussion

A severely contracted eye socket, the so-called "malignant" contracted eye socket, [1] cannot be corrected by conventional methods alone, such as a full thickness skin graft or a mucosal graft, because of the poor vascularity of the recipient bed and deficiency of tissue. The use of a prefabricated temporoparietal fascial flap [5–7], a temporal muscle flap combined with a skin graft [8], a posterior auricular flap [9,10], a lateral orbital flap, or an expanded median forehead flap [11], might be a good option in some cases, but when the defect is extensive the volume of the flap is not sufficient.

For such cases, we have used a free flap transfer for reconstruction of the eye socket since 1980. In 1993, Asato et al. [12] reported a series of 27 cases of reconstructions with free flap transfers. In most of their patients in whom eyelids were retained, they reconstructed the eye socket primarily with a free

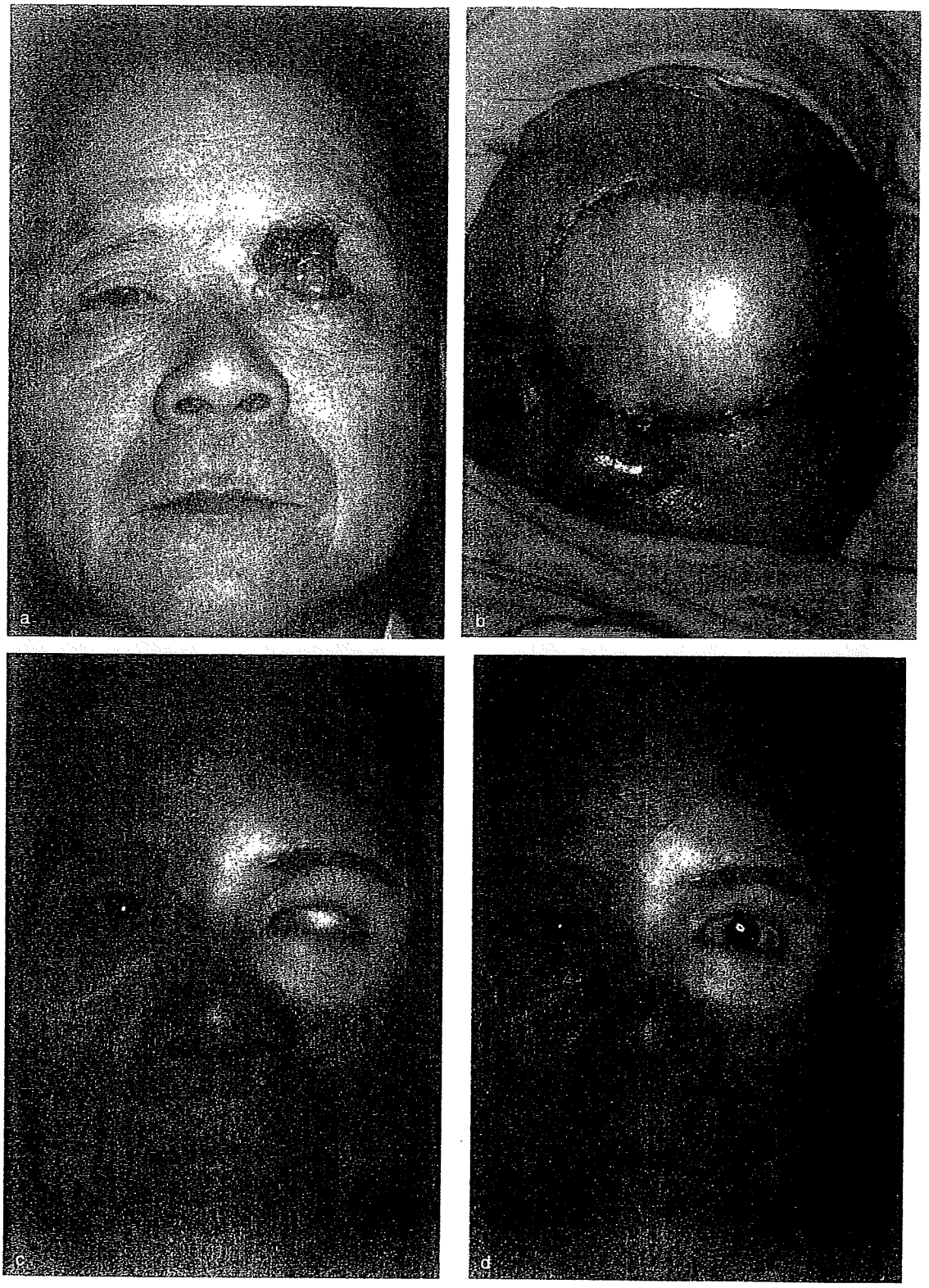

Figure 2. Case 4. (a) Preoperative view. (b) After radical excision of the tumour including excision of his left eye, a free latissimus dorsi musculocutaneous flap was transferred to the left superficial temporal vessels. (c) Final result without an ocular prosthesis, and (d) with an ocular prosthesis. Published with the patient's consent.

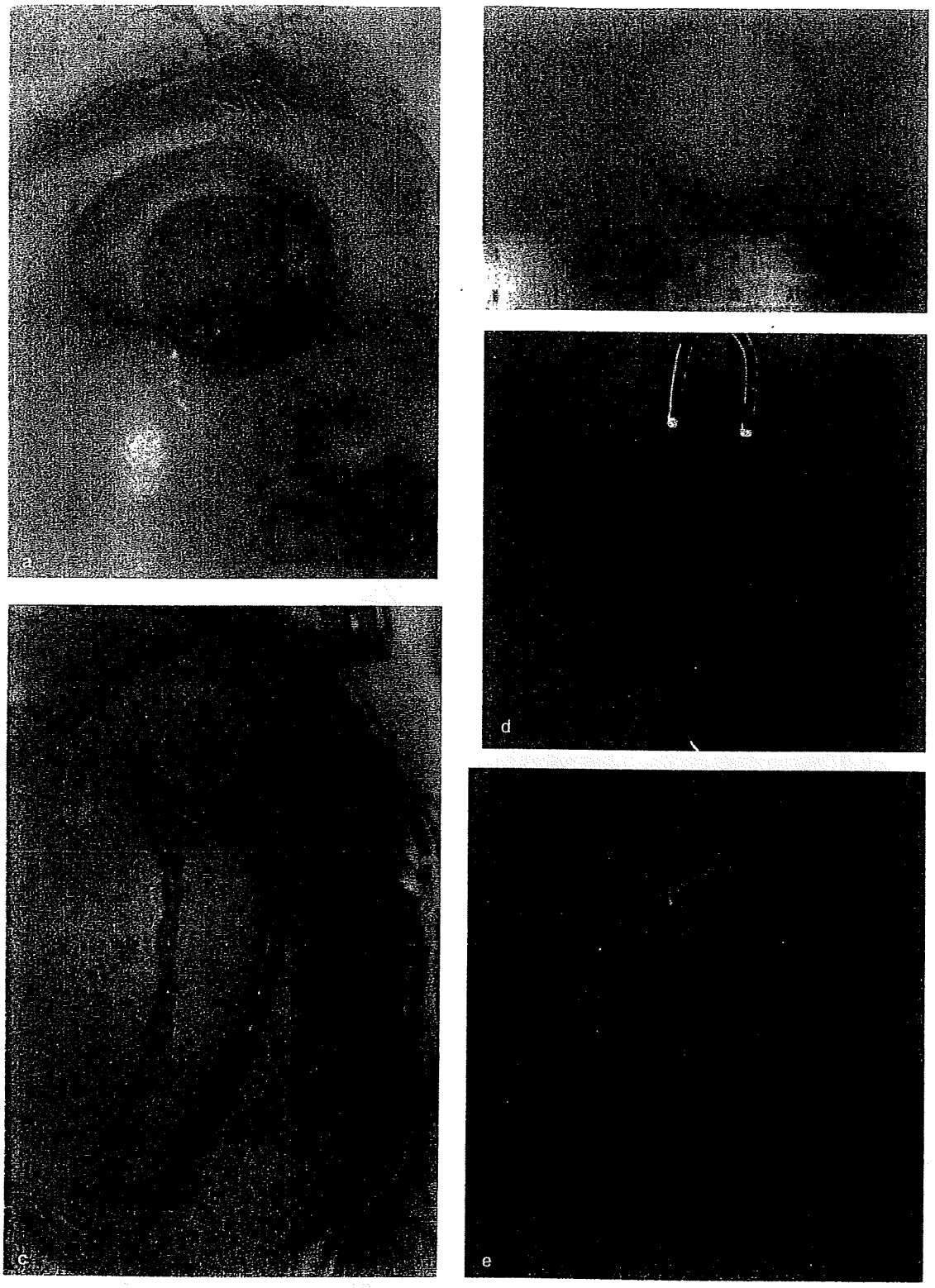

Figure 3. Case 5. *(a)* After resection of the tumour. *(b)* A resin ball draped with a skin graft. *(c)* After the resin ball had been implanted into the orbit, a free radial forearm flap was transferred. *(d)* At the time of removal of the resin ball, the skin graft had survived well. *(e)* Final result of the patient with an ocular prosthesis. (Published with the patient's consent).

flap transfer. In a patient whose conjunctival remnant was sufficient, the flap was buried in the orbit for augmentation alone. In a patient whose conjunctival remnant was not sufficient, they used the free flap for partial or total lining of the eye socket. However, in a patient who had had a complete resection, the defect could be covered only with a free flap transfer at the primary operation. In such cases, an eye socket should be reconstructed secondarily in the previously transferred free flap.

In our cases, the eye socket was reconstructed secondarily in a free flap with a skin graft. Though a skin graft on scar tissue is prone to a recurrent contracture, a skin graft on a free flap is resistant to contracture as a result of its abundant vascularity. The eye socket is therefore reconstructed in a free flap, where it retains sufficient volume to hold an ocular prosthesis. This is the main advantage of using a free flap at the primary operation, and assists in revision operations if required later. For patients who had postoperative radiotherapy for the treatment of retinoblastoma in infancy, the depression deformity is corrected by augmenting the soft tissue in the orbitozygomatic region [12].

We modified Antia's method [1] and used it for reconstruction in three cases. It is simple and gives a natural appearance to the eyelid and canthal region, as shown in cases 4 and 5. In recent cases, we bury the implant into the orbit at the same time as free flap transfer, as in case 5, for the patient who will need reconstruction of the eye socket later.

Because the anterior lobes of the eyelids were reconstructed with a free flap after excision of the orbit, the texture and colour match of the flap becomes a problem. Some local flaps (such as the lateral orbital flap or the median forehead flap) are superior to the free flaps as regards texture and colour match. Most patients tend to wear an eye patch even after reconstruction, and this prevents the flap from tanning, which is one of the causes of the mismatch of texture and colour. Some authors recommend the use of an external prosthesis when the defect is extensive. In some cases, this might be a good choice, but it cannot be worn on unstable skin.

Other serious problems are drooping of the flap, which results in ptosis of the lower eyelid. Drooping of the flap is inevitable, particularly when the bone of infraorbital rim is excised and the zygomaticomaxillary buttress is absent, and reconstruction of the socket becomes difficult. To correct ptosis of the lower eyelid a cartilaginous graft, suspension of fascia, or pedicled flap transfer may be attempted, but the results are usually disappointing. It is difficult to reconstruct the natural shape of the lower eyelid and canthal region by manipulating soft tissue in such cases.

Conclusion

Reconstruction of the eye socket in a free flap transferred after complete excision for malignancy is difficult. We applied a modified Antia's method for three patients, and obtained good aesthetic results. It is thought that this method offers a good option for eye socket reconstruction in a previously transferred free flap. However, mismatch of colour and texture and drooping of the flap are two major problems in such patients.

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Reconstruction with Rectus Abdominis Myocutaneous Flap for Total Glossectomy with Laryngectomy

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ABSTRACT

From October 1999 to July 2005, defects after total glossectomy with laryngectomy (TGL) for cancer of the tongue or middle pharynx were reconstructed with rectus abdominis myocutaneous (RAMC) flaps in nine patients. The skin flaps were designed larger in width than the original defect to create a funnel-shaped oropharynx and prevent stricture. Six patients had uneventful postoperative courses and began to eat perorally 8 to 15 days postoperatively. One patient suffered flap necrosis due to arterial thrombosis and two patients had leakage. Eventually, eight patients could eat soft foods or gruel, except one patient who had ingested food through a gastrostomy preoperatively. When TGL was performed without mandibulectomy, the blood supply for the remnant mucosa of the backside of the mandible is generally not good, for which the reconstruction with the overlapping deepithelialized flap and muscle is useful for prevention of the fistula formation. We considered that the RAMC flap is a good option for reconstruction after TGL.

KEYWORDS: Total glossectomy with laryngectomy, reconstruction, rectus abdominis myocutaneous flap

Total glossectomy with laryngectomy (TGL) is a surgical procedure that is performed for tongue-base cancers or advanced tongue cancers. Survival rates for advanced tongue carcinoma remain poor despite advances in multimodality therapy.[1–4] Five-year cure rates for stage IV tongue cancers treated with surgery with postoperative radiation therapy or radiation alone range from 17 to 33%.[2–4] Ruhl and colleagues[1] reported that corrected actuarial survival was 48 and 38% at 3 and 5 years, respectively, in 15 patients who had undergone TGL. Different from total glossectomy *without* laryngectomy (TGNL), the defect after TGL is extensive and involves the entire floor of the mouth and the anterolateral walls of the pharyngoesophageal tract. Although several reports on the prognosis after TGL have been published,[1–4] there are only a few reports[5,6] that focus on the procedure for reconstruction following extensive ablation, including TGL. Reconstruction after TGL does not require consideration for the restoration of postoperative articulation and deglutition without miss-swallowing. However, large and voluminous flaps are often needed because the defects are extensive and

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