significant functional and aesthetic defects and severe morbidity (Fig. 79-6).[13]

A reconstruction algorithm should be regulated by the type of patient, the size of the defect, the anatomic location of the defect, and the structures involved. Wells and Luce[13] proposed a classification of midfacial defects after resection of maxillary malignancies into five unique types according to the size of the skin defect, the extent of the loss of maxillary buttress, the size of the palatal defect, and the loss of orbital support. In the following sections, these types of midfacial defects are listed and categorized in accordance with the size and depth of the defect, location, and structures involved.

Type I Defect

A type I defect includes the cutaneous and superficial subcutaneous tissues. The underlying bony framework and deep structures are mostly intact. No penetrating defects to the aerodigestive cavities are noted. Surgery for burn scar, traumatic scar, and various nevi for which laser treatment is ineffective frequently results in a type I defect. When a skin defect cannot be closed directly, various standard reconstructive modalities for skin replacement are required. A simple skin graft or local flap reconstruction is the preferred choice.[14] Tissue expansion can provide a sufficient local skin flap with good color and texture from the surrounding region to close a relatively large defect, although some authors have reported a high complication rate.[15]

FIGURE 79-6. A full-thickness defect of the cheek after extensive resection of an advanced maxillary cancer and radiation treatment.

Type II Defect

Deeper soft tissue defects, sometimes including the mimetic and masticatory muscles, require greater bulk to restore facial contour. These are classified as type II defects and are frequently caused by progressive hemifacial atrophy (Romberg disease), lipodystrophy, localized morphea, severe hemifacial microsomia, and ablative surgery for extended malignant tumors of the parotid gland. Facial skin and intraoral mucosa are intact or minimally involved.

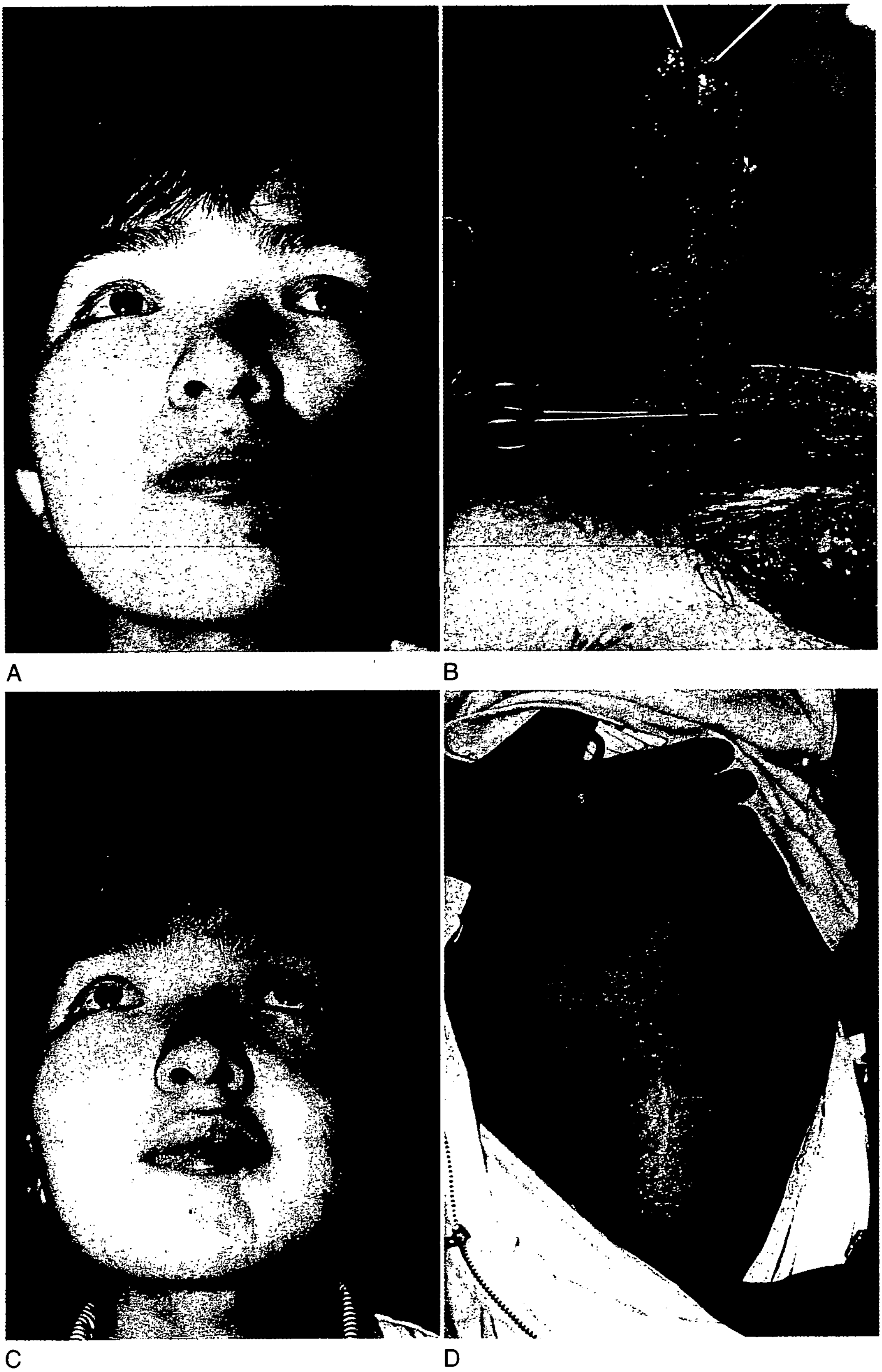
A de-epithelialized free skin flap or omental free flap is the ideal reconstructive option for augmentation of missing soft tissues for type II defects (Fig. 79-7).[16,17] A galea-temporoparietal fascia or temporal muscle flap can also augment a depressed orbital region and upper cheek with a simple technique when the defect is limited (Fig. 79-8).[18,19] A conventional pedicle flap from a distant area would be a choice only when local tissues cannot be employed or no vessels are available for free vascularized tissue transfers. A free autogenous fat or dermal fat graft is indicated when a defect is relatively small and has a well-vascularized bed.

When loss of the mimetic muscles results in facial paralysis (which greatly distresses patients because of facial asymmetry as well as dysfunction), a neurovascularized free muscle or musculocutaneous flap can often provide a good result (Fig. 79-9).[20,21]

Type III Defect

A full-thickness defect of the cheek predominantly results from resection of advanced malignant neoplasms. Simultaneous reconstruction of a through-and-through defect of both internal lining and external coverage requires a difficult and complex reconstructive procedure.[22-24] Pedicled or free musculocutaneous flaps, such as the pectoralis major, trapezius, latissimus dorsi, or rectus abdominis flap, can form two or more separated skin paddles on the muscle pedicle. This can then be safely folded to provide flaps for simultaneous coverage of both the internal lining and external skin defect of the cheek (Fig. 79-10).[25-29] In most situations, free musculocutaneous flaps are the most versatile choice because of their reliable vascularity. However, free fasciocutaneous flaps, such as the radial forearm flap, may also serve as a folded flap.[30,31]

Reconstruction of a total or subtotal nasal defect is also a challenging procedure because the nose is located



A B C D

FIGURE 79-7. A 20-year-old woman with severe progressive hemifacial atrophy (Romberg disease). *A,* Preoperative view. *B,* Elevation of a de-epithelialized groin flap, which was transferred to augment the depressed cheek. *C,* Two years postoperatively. *D,* A scar directly closing the donor defect is well accepted by the young woman. (From Hirabayashi S, Harii K, et al: A review of free de-epithelialized skin flap transfer for patients with progressive hemifacial atrophy. J Jpn Soc Plast Reconstr Surg 1987;7:260.)

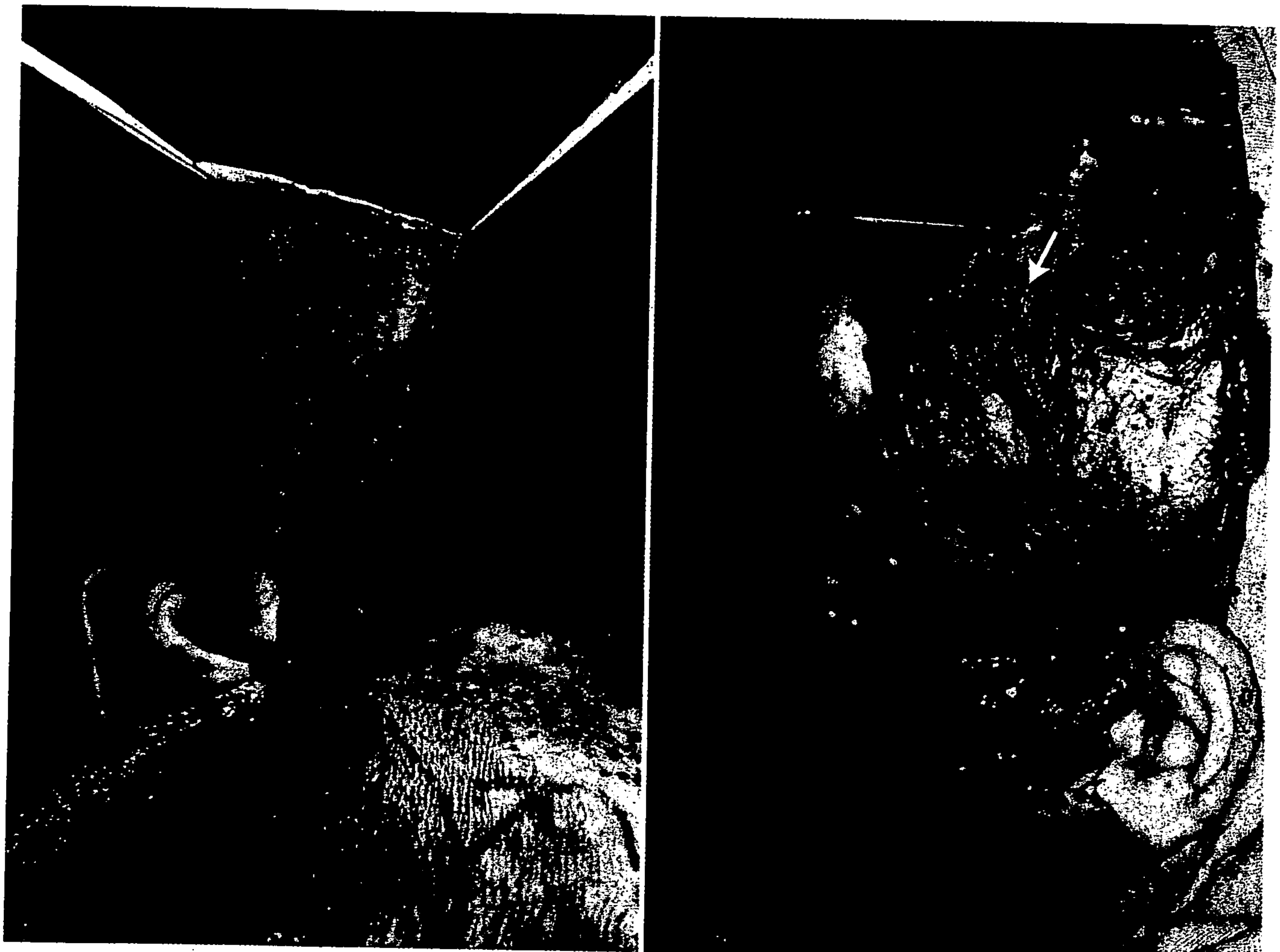


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FIGURE 79-8. *A,* Elevated galea-temporoparietal flap. *B,* A vascularized calvarial bone segment *(arrow)* elevated with a temporoparietal flap.

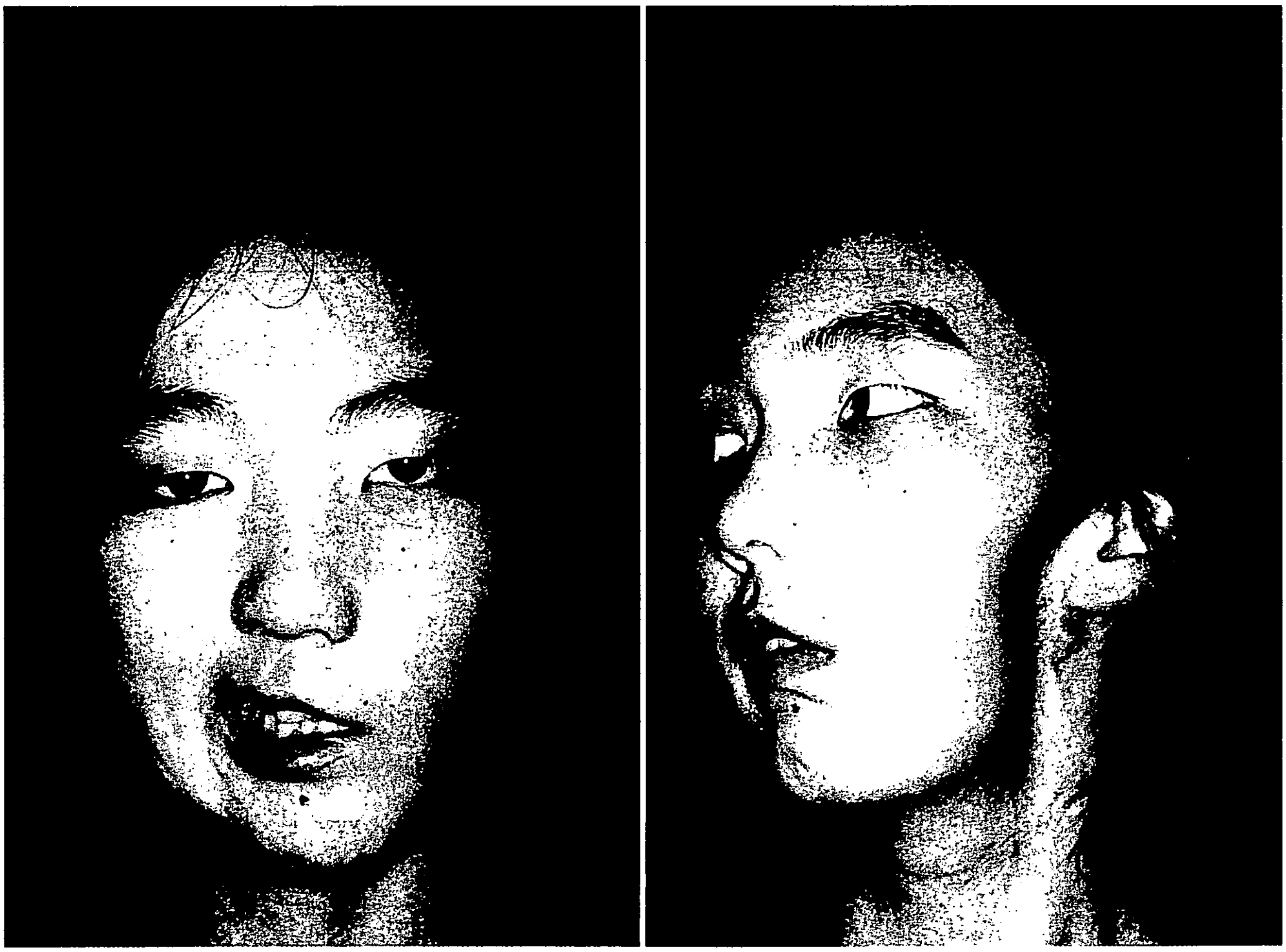

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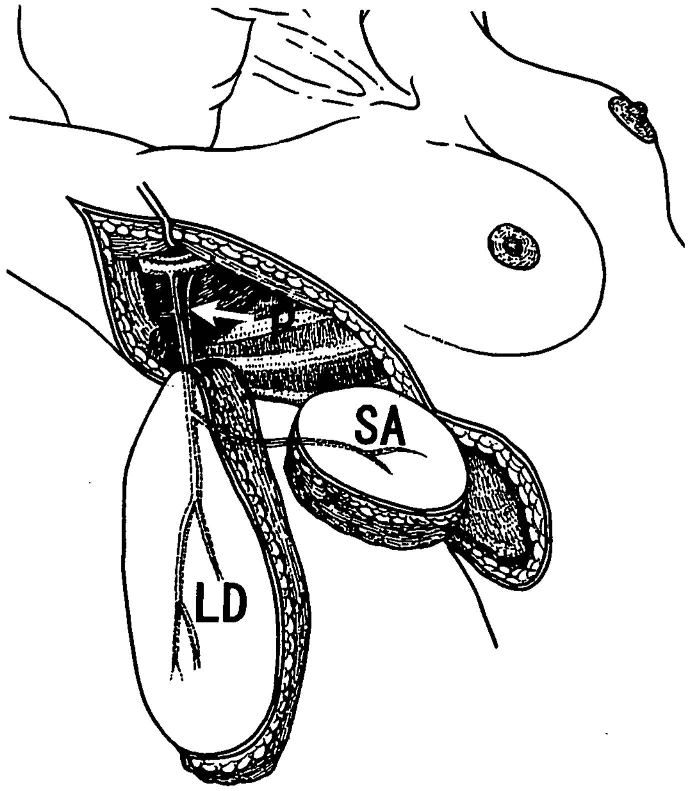
FIGURE 79-9. *A* and *B*, The patient with facial paralysis and cheek depression after extensive parotidectomy including the facial nerve is a good candidate for a neurovascular free muscle or musculocutaneous flap.



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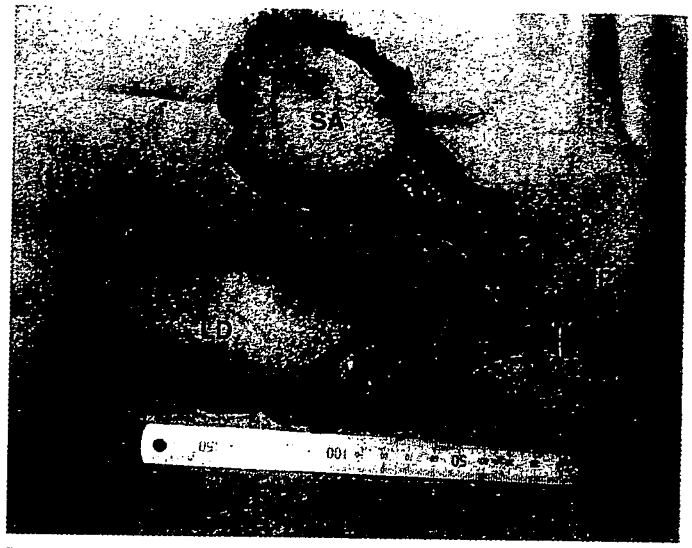

B

FIGURE 79-10. A double musculocutaneous flap with the latissimus dorsi and serratus anterior muscles, nourished by a common pedicle of the thoracodorsal-subscapular vessels, is available for closure of full-thickness cheek defects. *A*, Schema of flaps. *B*, Isolated flaps. LD, latissimus dorsi flap; SA, serratus anterior flap; P, thoracodorsal-subscapular vessel pedicle.

in the center of the face and therefore requires a good aesthetic result.[32] A forehead flap is the best reconstructive option for the nose because of its good color and texture match and proper skin thickness. An expanded forehead flap can provide a sufficient amount of tissue for reconstruction of the total nose.[33,34] A free flap may be an alternative if forehead skin is not available or the patient refuses the use of forehead skin because of its conspicuous donor scar (Fig. 79-11). The free flaps currently used, however, are either a poor color and texture match or of an unfit thickness. Development of a new flap or prefabricated flap would be required to achieve a better result.[35]

Type IV Defect

Type IV defects include deformities to bony structures or bony frameworks (buttresses) of the maxilla and zygoma leading to significant aesthetic deformities of the cheek as well as serious functional morbidity of the eye and dentition. Trauma, severe congenital facial cleft, and tumor ablation may cause this type of defect. Although a large defect of the anterior maxillary wall may cause a depression deformity of the cheek from collapse of the subcutaneous soft tissues into the paranasal sinus, loss of the multiplanar buttresses causes severe deformities of the orbit, cheek, and alveolus.[36,37] Type IV defects are further divided into two subtypes, IVA and IVB.

TYPE IVA DEFECT

Partial loss of the maxilla with loss of the palate and alveolar ridge is a type IVA defect. The nasomaxillary and zygomaticomaxillary buttresses and floor of the orbit including Lockwood ligament are intact. In maxillary cancer cases, this type of bone defect is usually associated with loss of the internal mucosal lining, which permits use of a free skin graft and allows the use of a denture prosthesis. The prosthesis also serves as a palatal obturator and assists in maintaining midfacial projection.

TYPE IVB DEFECT

A type IVB defect indicates a more extensive loss of the maxillary bone including the nasomaxillary and zygomaticomaxillary buttresses, palate, and floor of the orbit. Total maxillectomy for maxillary cancer frequently leads to this type of defect. Devastating trauma, such as a gunshot wound, also causes an extensive defect of the maxilla; however, this type of defect occurs in far fewer patients than do those defects resulting from resection of maxillary cancer. Reconstruction of the bony constitution, especially the upper horizontal buttress and orbital floor, is required for maintenance of facial contour and prevention of dislocation of the globe (Fig. 79-12). When soft tissue lining is complete, an autogenous free bone graft or costal cartilage graft may safely replace the

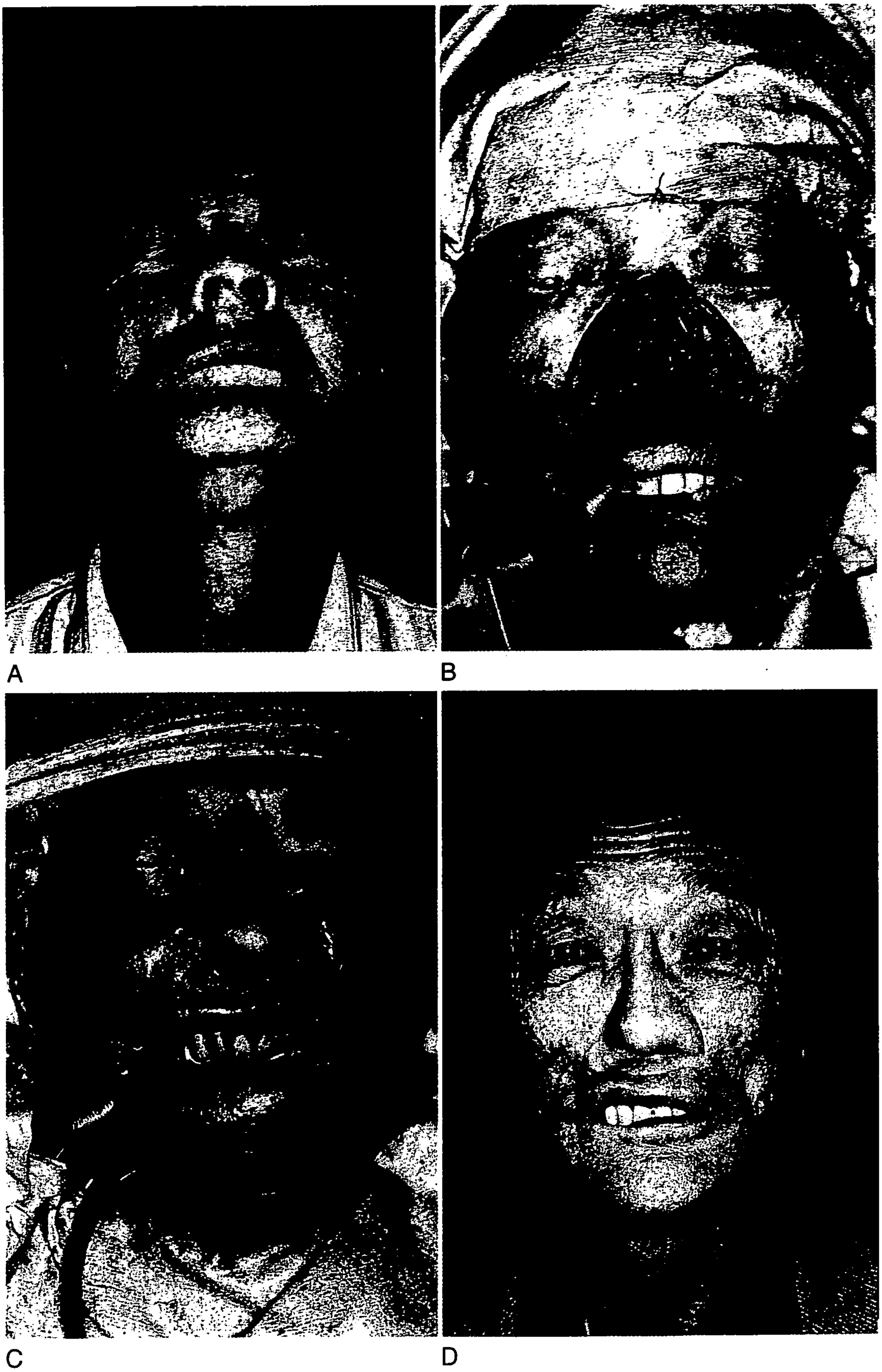

FIGURE 79-11. A 69-year-old man with a squamous cell carcinoma originating from the nostril floor. Despite an innocuous external appearance, the tumor was invasive to a wide area of the nose. *A*, Preoperative view. *B*, Extensive nasal defect after wide resection of the tumor required immediate reconstruction for nasal function and appearance. *C*, Because the defect was too extensive in this particular case, a free radial forearm flap was employed instead of a standard forehead flap. The lining was made by bilateral nasolabial flaps. An iliac bone strut was also used to support the nasal height. *D*, Good appearance obtained 6 months postoperatively. (From Takushima A, Asato H, Harii K: Reconstructive rhinoplasty for large nose defects. Jpn J Plast Reconstr Surg 2003;46:881.)

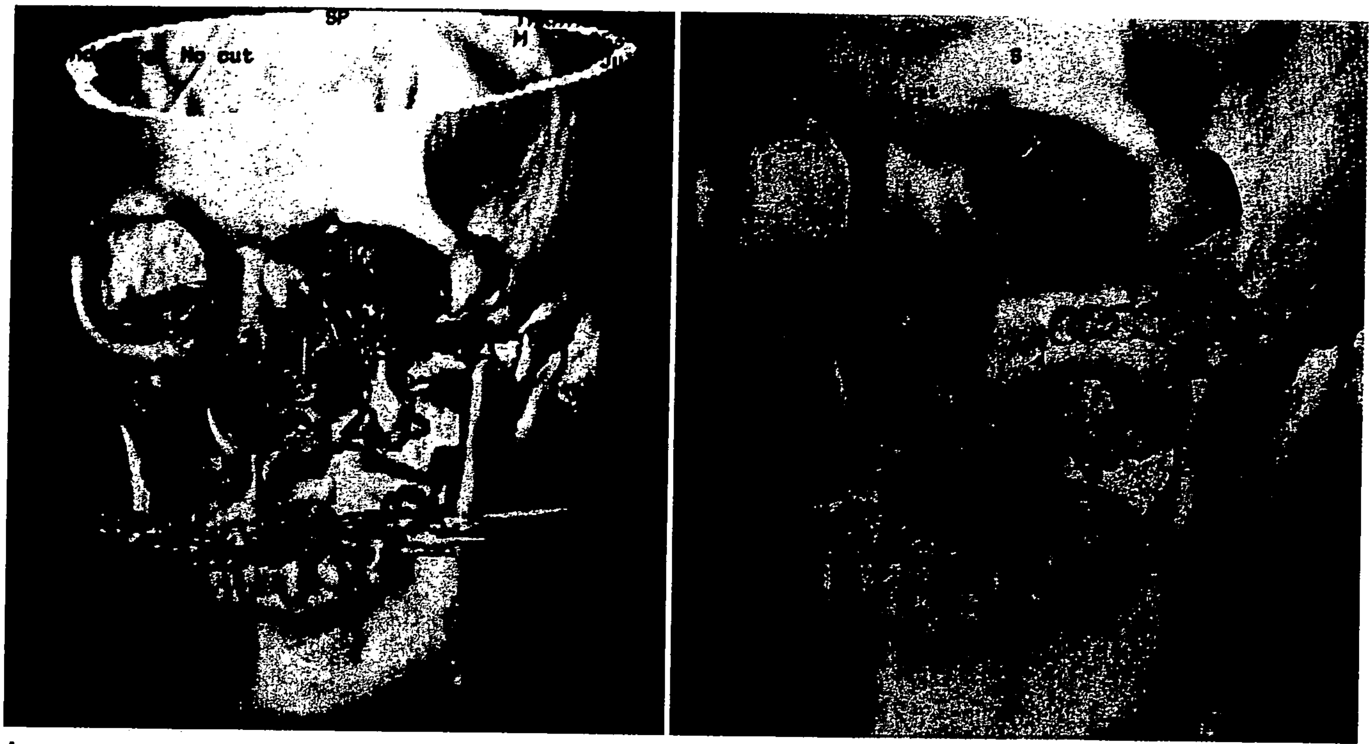

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FIGURE 79-12. *A*, Three-dimensional computed tomographic image of an extensive loss of the upper part of the maxillary bone after resection of a sarcoma in a 27-year-old man. *B*, Three-dimensional computed tomographic image, 6 months postoperatively, after reconstruction of the upper horizontal buttress by a free scapular osteocutaneous flap to correct the downward dislocation of the eye. Arrow indicates a well-surviving scapular bone segment placed into the bone defect of the upper maxillary buttress.

buttresses.[38] A vascularized calvarial bone graft pedicled by the temporoparietal fascia is especially useful for reconstruction of infraorbital and zygomatic regions of the midface.[39-41] However, its size is limited, and difficulty in fabrication may be a problem. In contrast, a free vascularized bone graft or osteocutaneous flap offers a more reliable bone replacement option for extensive bone defects, although the surgical technique is more complex.[42,43]

Reconstruction of the alveolar ridge is also important to affix dentures. Osseointegration has now been popularized in restorative dentistry to stabilize prostheses,[44,45] but it frequently requires an adequate bony support or platform using vascularized bone grafts.[46,47]

Type V Defect

A total maxillectomy with palatectomy for maxillary cancer or devastating injury to the midface may frequently result in massive defects, or a type V defect, combining the maxillary bony framework, mucosal lining, and cutaneous coverage. Reconstruction is challenging for these defects because the complex maxillary framework or buttresses should be replaced by a suitable support; extensive soft tissue replacement may also be required. In most instances, free flaps are the best reconstructive option because they provide various types of composite tissues in addition to adequate vascularity in a single-stage operation (Fig. 79-13). Of the free flaps currently used, the free scapular osteocutaneous flap and fibular osteocutaneous flap are preferred. These flaps provide a well-vascularized bony support as well as skin flaps for covering skin or mucosal defects. Dual transfer of the osteocutaneous flap and radial forearm flap is also useful for reconstruction of complex defects including maxillary bone, mucosal lining, and skin.

FIGURE 79-13. A 57-year-old man with a large low-grade adenocarcinoma originating from the bilateral maxillary sinuses. *A*, Preoperative view. *B*, Extensive defects of the lower part of the bilateral maxillary bones including oral mucosa and cheek skin. *C*, For immediate closure of these extensive defects, double free flaps including the latissimus dorsi flap (LD) and serratus anterior flap with a rib segment of 10 cm (SA) were harvested and transferred with anastomoses between the facial vessels and thoracodorsal vessels (P). The rib segment was fixed to the bilateral zygomatic arches with miniplates and K-wire. *D* and *E*, Postoperative view and computed tomographic image (arrow indicates the grafted rib segment) 6 months later.

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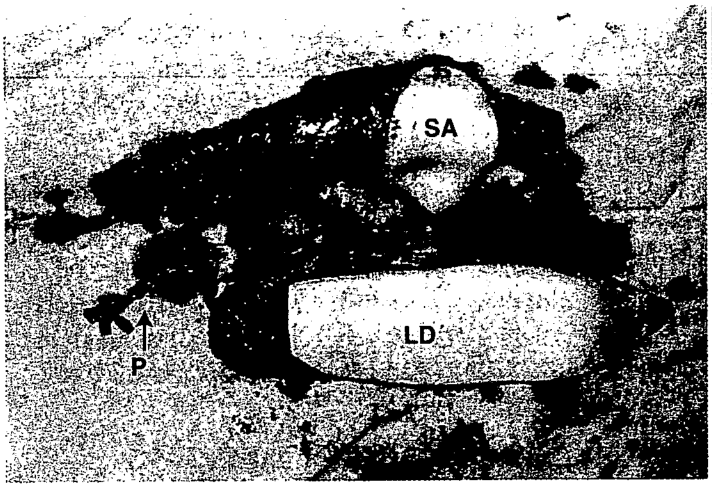
B



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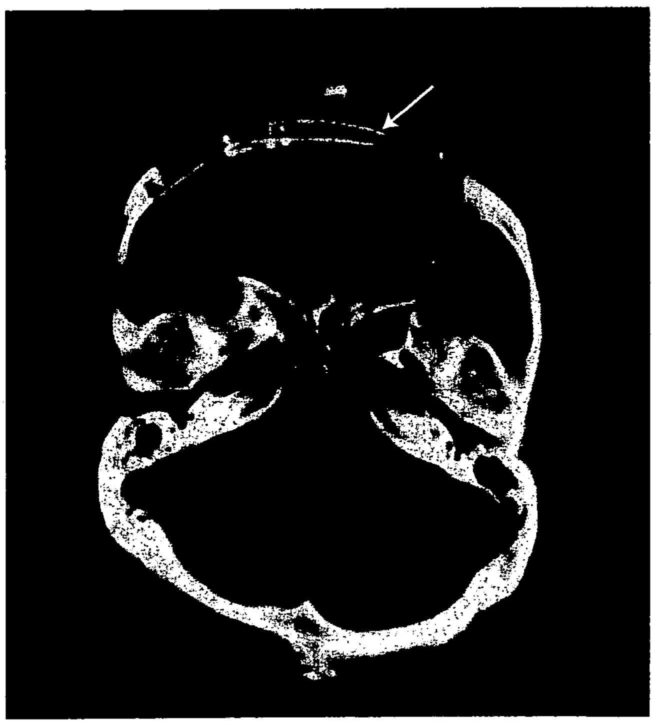

E

OPERATIVE MANAGEMENT

Skin and Soft Tissue Defects

SKIN GRAFT

A free skin graft is the most simple and traditional surgical treatment option when a defect is limited to the skin or superficial cutaneous layer (type I defect, such as postexcisional defect of scar tissue after a burn injury or trauma). The regional aesthetic units should be considered to obtain inconspicuous scar margins of skin grafts.[6] Full-thickness skin grafts usually produce better cosmetic results than do split-thickness skin grafts. The skin graft, however, cannot usually provide skin of an analogous color or texture, and the aesthetic result is frequently poor (with the possible exception of resurfacing eyelids with a postauricular skin graft). Recruitment of free skin grafts in midface reconstruction is therefore limited from an aesthetic standpoint.

LOCAL FLAP AND SOFT TISSUE EXPANSION

A good functional and aesthetic result requires reconstruction to replace missing tissue with similar tissue. Local flaps, such as rhomboid flaps or subcutaneous flaps, can migrate skin with similar color and texture to the missing skin.[48] They produce a good aesthetic result for closure of relatively small but deeper defects. However, secondary scarring after the use of local flaps should always be considered. A flap developed in the forehead can safely provide skin of good-quality color and texture for reconstruction of the nose and midface, but resulting scars in the forehead may present a problem.[22] An expanded forehead flap can provide a sufficient soft tissue flap with minimal donor site scars for reconstruction of a total defect of the nose (Fig. 79-14). A malar flap or cervicofacial fasciocutaneous flap[49,50] is another option for closure of relatively large and full-thickness defects of the cheek. Soft tissue expansion can greatly extend the application of local flaps for large defects in the head and neck.[15,51] An expanded cervicofacial flap can be especially useful for extending the flap to the high cephalad level of the cheek and the lower eyelid (Fig. 79-15).[52] For larger defects, distant or free flaps may be required.

DISTANT FLAP

Before introduction of the musculocutaneous flap, the deltopectoral flap developed by Bakamjian[53] was the preferred procedure for head and neck reconstruction. Staged procedures and limited reach of the pedicle, however, make this reconstruction difficult and lengthy, and it has now been primarily replaced with musculocutaneous flaps such as the pectoralis major, latissimus dorsi, and trapezius.[54] Of these, the pectoralis major musculocutaneous flap developed by Ariyan[55] is one of the preferred musculocutaneous flaps for head and neck reconstruction. The pectoralis major musculocutaneous flap can be extended up to the cheek and infraorbital regions, although vascularity of a skin paddle developed from the distal portion of the pectoralis major muscle may sometimes be unstable. The donor site scar and resulting disfigurement, however, may be a problem for some patients.

The latissimus dorsi muscle has a long vascular pedicle, and its pedicled musculocutaneous flap can reach the zygomaticotemporal region.[56] Vascularity of a large skin island developed on the muscle is highly reliable when the flap includes one or more musculocutaneous perforators. Several skin paddles can be designed on the latissimus dorsi muscle and employed as a folded flap to close a full-thickness defect of the oral and pharyngeal regions. The main drawback of the latissimus dorsi musculocutaneous flap for head and neck reconstruction is the difficulty in positioning the patient for simultaneous resection and flap dissection. This frequently requires a change in the patient's position during surgery and lengthens the operation time.

Other pedicled musculocutaneous flaps, such as the trapezius and sternomastoid flaps, may also be employed for repair of cheek and midface defects. However, because of freedom of flap design and the ability to transfer various types of tissues, the microvascular free flap is generally more versatile than the pedicled flap in head and neck reconstruction.

MICROVASCULAR FREE FLAPS

Microvascular free flap transfer has enabled the development of many new fields of reconstructive surgery in the head and neck. Free skin flaps, such as the groin and deltopectoral flaps, were first employed for resurfacing cutaneous defects of the face and neck[57] or for augmentation of depressed areas of the face as a de-epithelialized flap.[58] A sufficient amount of soft tissue required in the recipient site can be transferred in a one-stage operation. Selection of adequate donor tissue matching the recipient defect provides the best reconstructive option.

Midface reconstruction, however, has been greatly advanced by clinical introduction of various reliable microvascular free flaps, such as free musculocutaneous and fasciocutaneous flaps, in the 1980s. Free musculocutaneous flaps, such as the latissimus dorsi and rectus abdominis flaps, provide a thick soft tissue flap suitable for repair of large or deep midfacial and cheek skin defects. These musculocutaneous flaps can be folded and used to reconstruct a full-thickness cheek defect (Figs. 79-16 and 79-17).[25,28,29] When a skin defect is relatively small and thin, free fasciocutaneous flaps, such as the radial forearm flap, dorsalis pedis flap, or

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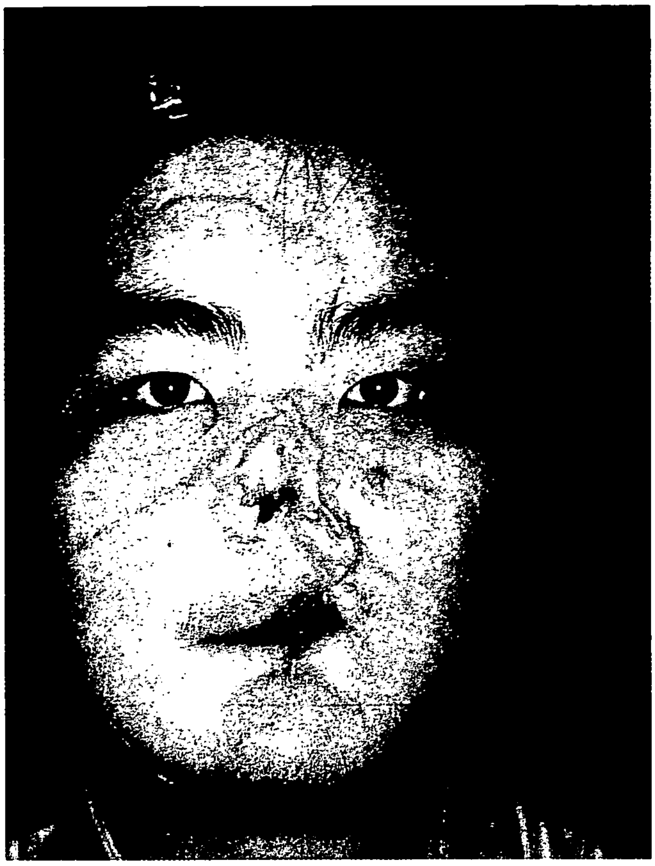

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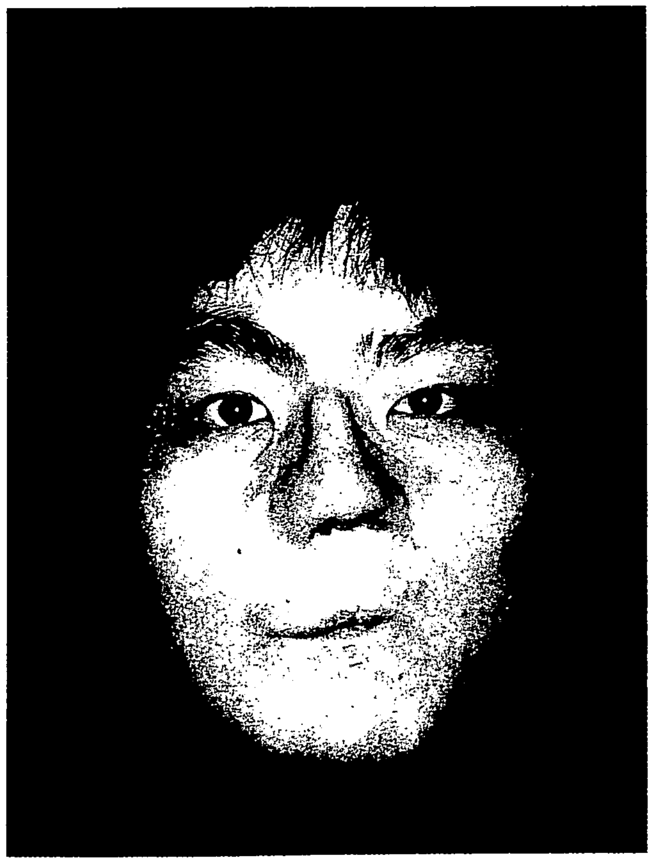

C

FIGURE 79-14. A 27-year-old man with total loss of his nose due to a severe industrial accident. *A,* Preoperative view. *B,* Expanded forehead flap used for nasal reconstruction. *C,* The reconstructed nose shows good appearance with good color and texture matching to the face 1½ years later. The donor site scar is also acceptable.

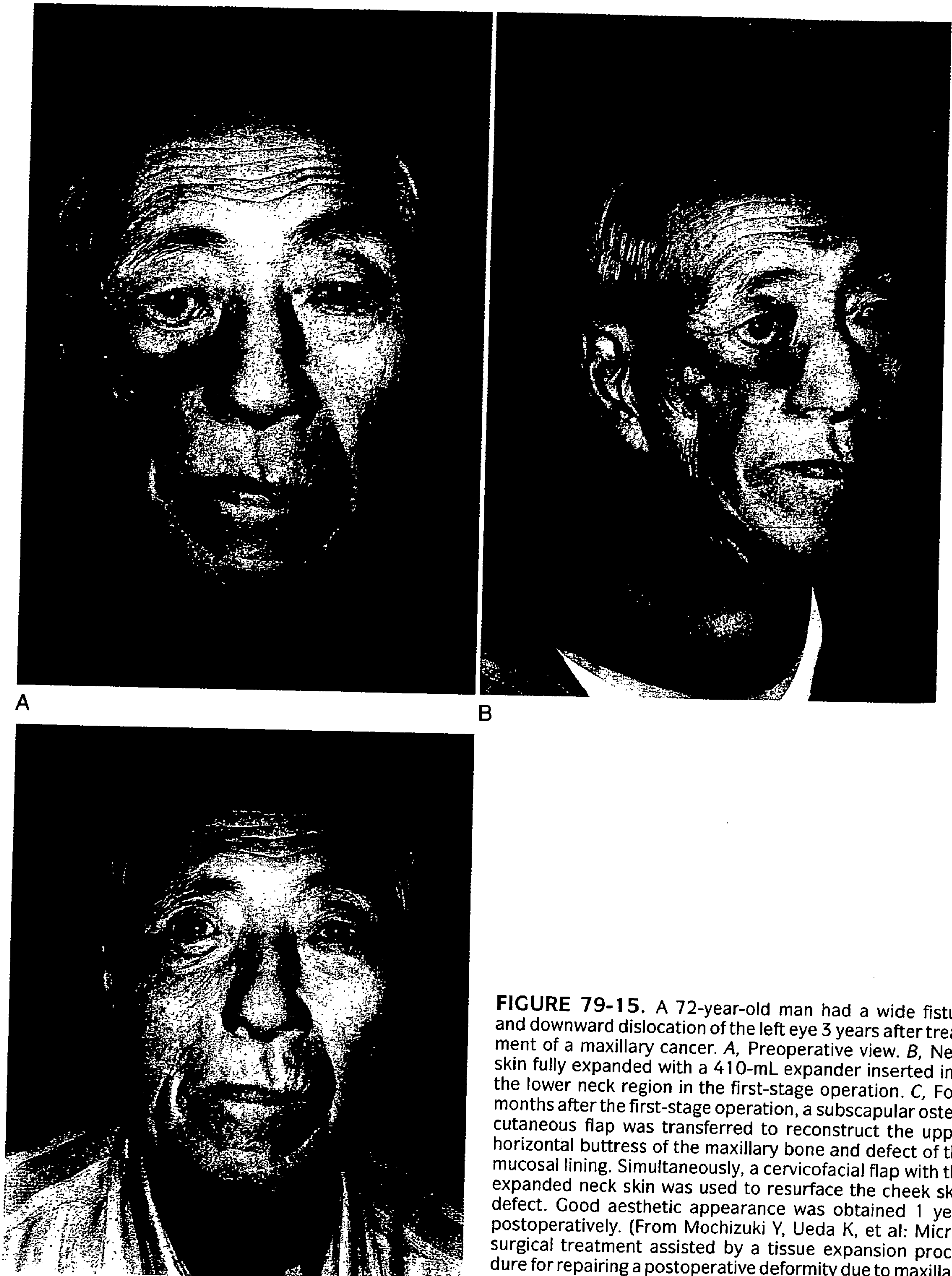

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FIGURE 79-15. A 72-year-old man had a wide fistula and downward dislocation of the left eye 3 years after treatment of a maxillary cancer. *A,* Preoperative view. *B,* Neck skin fully expanded with a 410-mL expander inserted into the lower neck region in the first-stage operation. *C,* Four months after the first-stage operation, a subscapular osteocutaneous flap was transferred to reconstruct the upper horizontal buttress of the maxillary bone and defect of the mucosal lining. Simultaneously, a cervicofacial flap with the expanded neck skin was used to resurface the cheek skin defect. Good aesthetic appearance was obtained 1 year postoperatively. (From Mochizuki Y, Ueda K, et al: Microsurgical treatment assisted by a tissue expansion procedure for repairing a postoperative deformity due to maxillary cancer. J Jpn Soc Reconstr Microsurg 2001;14:24-31. Courtesy of Professor Kazuki Ueda.)

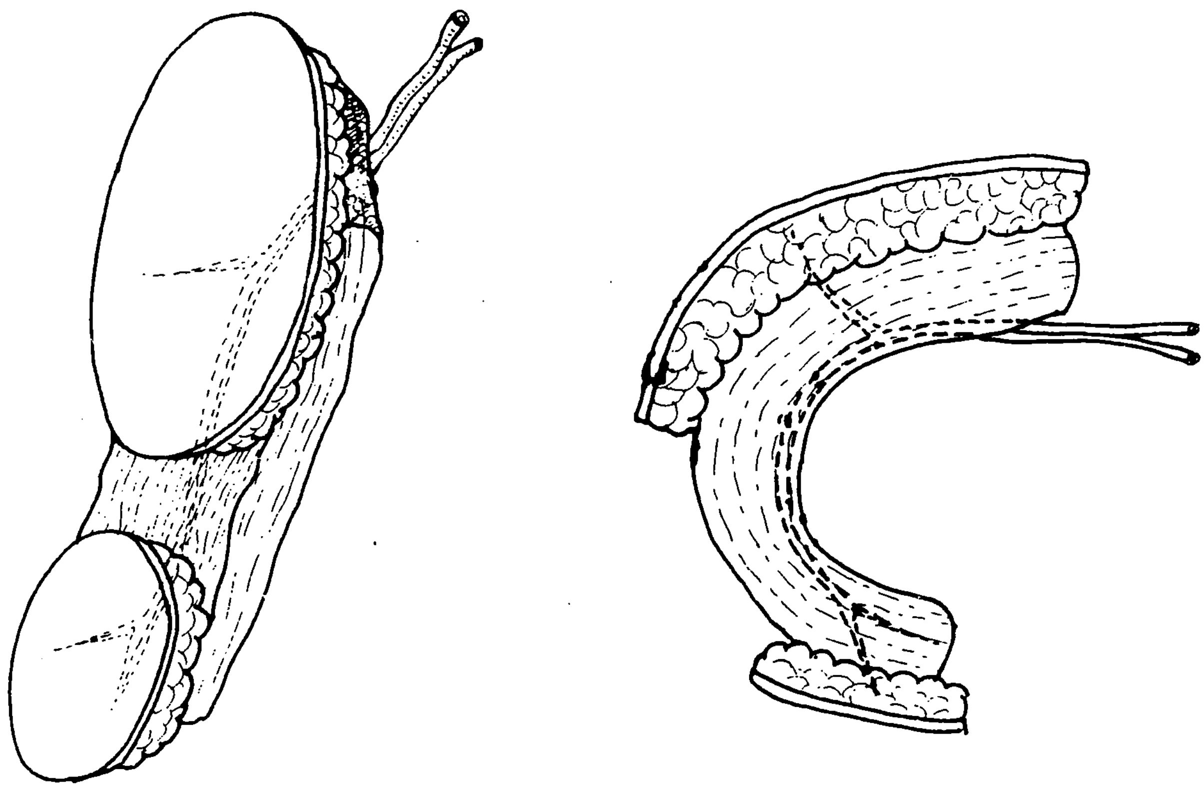

FIGURE 79-16. Schema of a folded free musculocutaneous flap available for simultaneous closure of a full-thickness cheek defect.

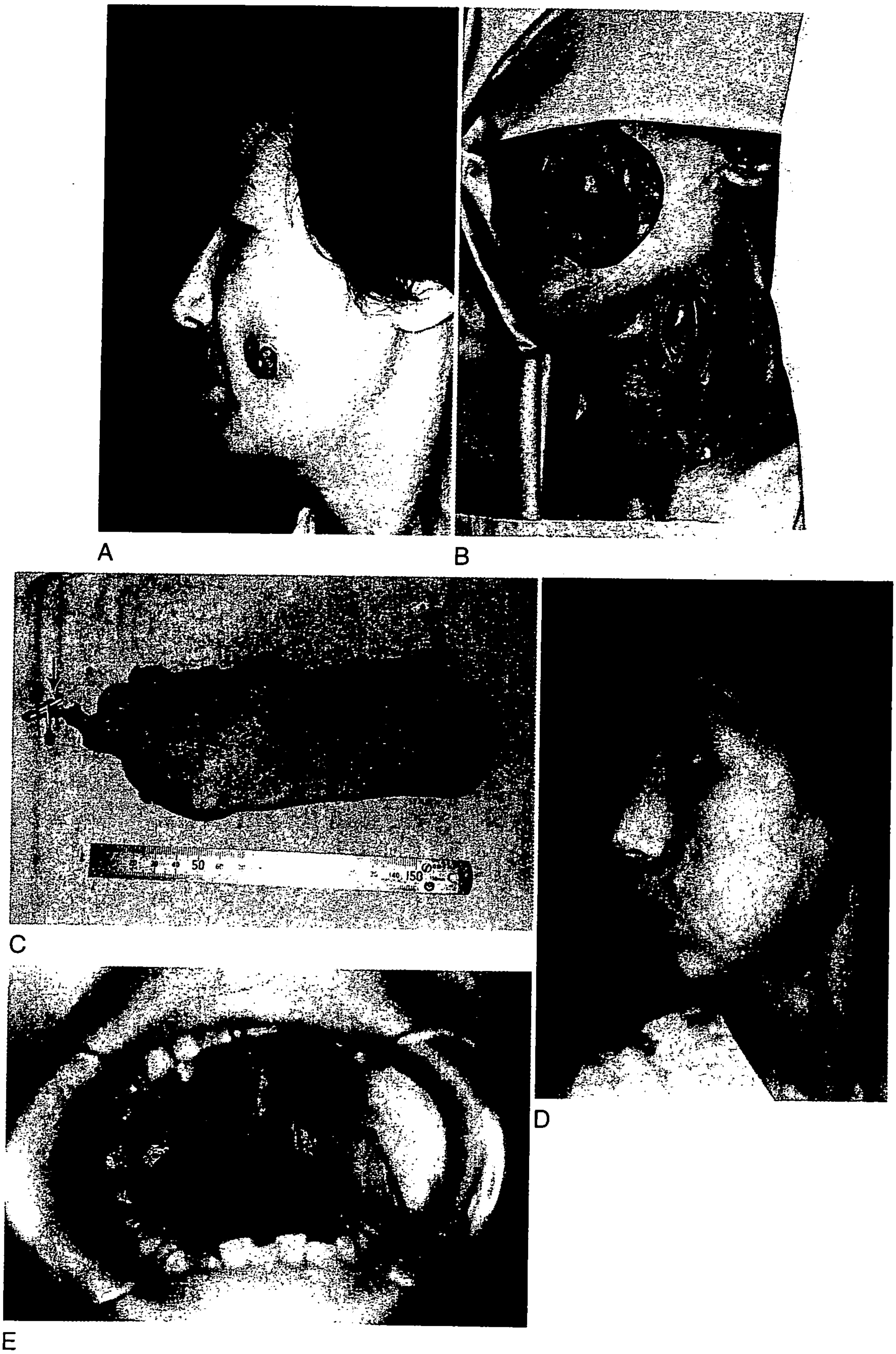

FIGURE 79-17. A 55-year-old woman with squamous cell carcinoma originating from the left buccal mucosa and invading the cheek skin. *A,* Preoperative view. *B,* A full-thickness cheek defect after extensive resection of the tumor and modified neck dissection. *C,* An isolated rectus abdominis flap is going to be folded (arrow shows the pedicle inferior epigastric vessels). *D* and *E,* Five years postoperatively, good closure of both external surface and internal lining is achieved in a single operation. (From Nakatsuka T, Harii K, Yamada A, et al: Versatility of a free inferior rectus abdominis flap for head and neck reconstruction: analysis of 200 cases. Plast Reconstr Surg 1994;93:762-769.)

anterolateral thigh flap, offer excellent reconstructive options.

Skeletal Defects

When a maxillary defect is small and has good soft tissue coverage, an autogenous free bone or costal cartilage graft can survive. Bioinactive or biocompatible alloplastic materials, such as titanium mesh and hydroxyapatite, may be advocated when poor local tissue factors such as irradiation and scar do not exist. In contrast, a vascularized bone graft or osteocutaneous flap can reliably provide various types of vascularized bone segments with or without cutaneous flaps for osseous reconstruction of maxillary defects. These flaps can recruit the missing buttresses of the maxilla so that facial contour can be maintained aesthetically. The free scapular osteocutaneous flap is among the most preferred donor flaps because it can simultaneously provide a well-vascularized segment of the lateral border and inferior angle of the scapula as well as skin.[42] Great freedom in spatial orientation of skin and bone segments enables the surgeon to achieve a three-dimensional reconstruction of a complex defect of the maxilla and midface (Fig. 79-18). A relatively thin scapular bone segment may also be an option for reconstruction of a maxillary bone defect. A long stalk of the circumflex-subscapular vessel pedicle can be anastomosed to the external carotid branches, but an interpositional vessel graft or flow-through flap should be used when the recipient vessels are beyond the length of the flap's vascular stalk.[59] The authors recommend employing a radial forearm flap as a flow-through flap in patients with severe midfacial deformities after treatment of maxillary cancer for which several types of tissue flaps including vascularized bone segments are required. In most instances, a scapular osteocutaneous flap is attached to the distal stump of the radial vessels when a maxillary buttress needs to be reconstructed (Fig. 79-19).

The angular branch of the thoracodorsal vessels can also nourish the inferolateral segment of the scapula[60] and be transferred with a latissimus dorsi flap for reconstruction of type V defects. A combination scapular flap, latissimus dorsi flap, and serratus anterior flap, sometimes including ribs, is available for reconstruction of multiple defects in the midface.[61,62]

Muscle Defects

Irreversible or long-standing facial paralysis due to permanent damage to the facial nerve, resection of the mimetic muscles, or congenital deficiency is one of the most challenging problems in midfacial and cheek reconstruction. Microneurovascular free transplantation of various skeletal muscles has now been popularized and is a well-established procedure, often yielding natural or nearly natural cheek movement on smiling.[63-66] For a successful result to be obtained with this procedure, selection of an adequate motor nerve in the cheek is extremely important. In some patients who have undergone tumor resection including the facial nerves and mimetic muscles, a residual branch of the facial nerve may be available for reinnervation of a transplanted muscle. Because suitable facial nerve branches are frequently unavailable in the paralyzed cheek, a two-stage method combining a cross-facial nerve graft and muscle graft has long been championed and promises a good result with a natural or nearly natural smile.[64,65] However, this procedure requires a staged operation and a lengthy waiting period before contraction of a transplanted muscle is obtained. Sequelae such as hypoesthesia and paresthesia in the lateral foot after harvesting of a sural nerve segment for a cross-

FIGURE 79-18. A scapular osteocutaneous flap with two separated skin paddles (arrow shows a vascularized scapular bone segment).

FIGURE 79-19. A severe cheek deformity in a 45-year-old woman after treatment of a right maxillary carcinoma. *A,* Preoperative view. *B,* A sequentially linked radial forearm flap (R) with a scapular osteocutaneous flap (S) is shown. The radial forearm flap was used to reconstruct the oral mucosal defect, and the scapular osteocutaneous flap was used to reconstruct the upper horizontal buttress of the maxilla and augment the depressed cheek. The radial vessels of the forearm flap were anastomosed to the facial vessels; the circumflex scapular vessels (SA) nourishing the scapular flap were anastomosed to the distal end of the radial vessels (D). *C,* Good facial appearance is obtained 8 years postoperatively.

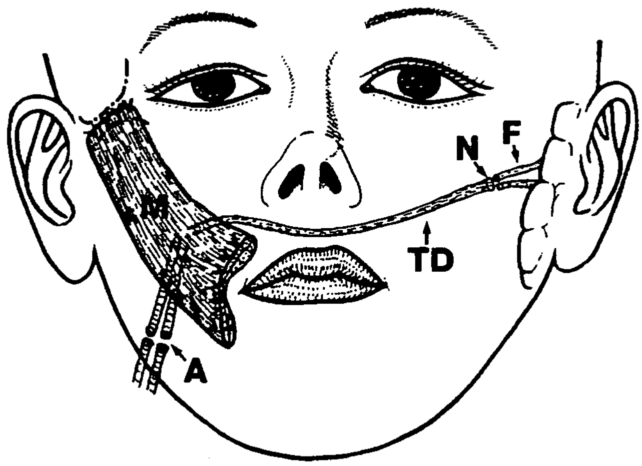

FIGURE 79-20. Schema of the one-stage reconstruction of a paralyzed face with a latissimus dorsi muscle segment in which the thoracodorsal motor nerve is crossed through the upper lip and sutured to the contralateral facial nerve branches. M, latissimus dorsi muscle; A, site of vascular anastomosis; N, site of nerve suture; TD, thoracodorsal nerve; F, intact facial nerve in the nonparalyzed cheek. (From Harii K, Asato H, Yoshimura K, et al: One-stage transfer of the latissimus dorsi muscle for reanimation of a paralyzed face: a new alternative. Plast Reconstr Surg 1998;102:942.)

face nerve graft may also occur and cannot be disregarded.

To overcome the drawbacks of the two-stage method, a one-stage method has been developed with use of the latissimus dorsi muscle segment.[21] The thoracodorsal nerve is directly crossed through the upper lip and sutured to the contralateral nonparalyzed facial nerve branches (Fig. 79-20).[21] Through a preauricular face lift incision on the paralyzed cheek, the cheek skin is widely undermined to develop a subcutaneous pocket to accept a subsequent muscle graft. Through an additional small incision in the submandibular region, the facial artery and vein (respectively) are exposed as the recipient vessels. During preparation of the recipient cheek, a segment of the latissimus dorsi muscle (an average of about 3 cm wide and 8 cm long), with its neurovascular pedicle, is harvested by another operative team. The thoracodorsal nerve should be dissected proximally to its origin from the posterior cord of the brachial plexus to obtain sufficient length (≥13 cm). This provides enough length to reach the contralateral facial nerve branches exposed through a small incision, less than 2 cm long, at the anterior margin of the parotid gland. The isolated muscle segment is then transferred to the recipient cheek and fixed between the zygoma and the nasolabial region under proper tension. The neurovascular anastomoses are then carried out under an operating microscope. Reinnervation of the transferred latissimus dorsi muscle is established at a mean of 7 to 8 months postoperatively (Fig. 79-21).

SUMMARY

Reconstruction of the midface is a challenging and difficult task for reconstructive plastic surgeons. Many defects are composite, involving many layers of skin, subcutaneous soft tissues, maxillary scaffolds, and mucosa. Aesthetic as well as functional results are important because morbidity seriously influences a patient's quality of life. Development of microvascular tissue transfer now offers various reconstructive options and has greatly improved the results of midface reconstruction. Multidimensional approaches, including conventional surgical and prosthetic procedures, however, should be considered in accordance with the individual patient and specific defect.

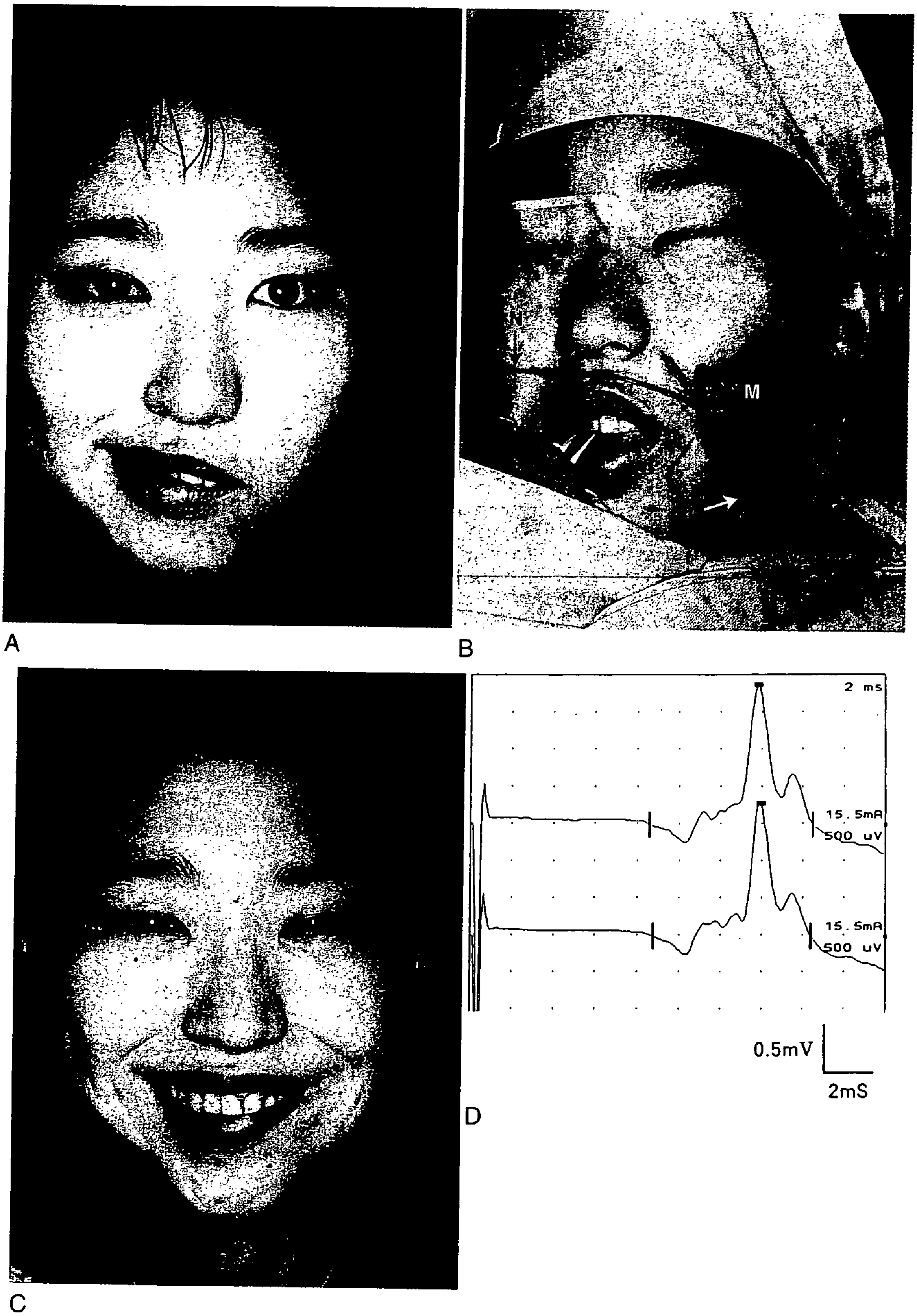

FIGURE 79-21. A 22-year-old woman with severe incomplete left facial paralysis after parotidectomy more than 10 years earlier. *A*, Preoperative view on smiling. *B*, Smile reconstruction as accomplished with a one-stage transfer of the latissimus dorsi muscle segment. The transferred latissimus dorsi muscle is shown. M, muscle; N, thoracodorsal nerve crossing the upper lip to the contralateral cheek; P, thoracodorsal vessels anastomosing to the recipient facial vessels. *C* and *D*, At $3^1/_2$ years postoperatively, a natural smile is obtained with high evoked potentials from the transferred muscle on stimulation of the contralateral facial nerve. (From Harii K, Asato H, Yoshimura K, et al: One-stage transfer of the latissimus dorsi muscle for reanimation of a paralyzed face: a new alternative. Plast Reconstr Surg 1998;102:945.)

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Analysis of Salvage Treatments following the Failure of Free Flap Transfer Caused by Vascular Thrombosis in Reconstruction for Head and Neck Cancer

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Background: Few authors have reported the subsequent treatment for patients in whom free tissue transfers in the head and neck have failed as a result of vascular thrombosis.
Methods: Between 1993 and May of 2005, 502 free flaps were transferred after head and neck cancer ablation in the authors' hospital, 19 of which resulted in total necrosis caused by vascular thrombosis. The authors categorized these 19 cases into four groups and analyzed the salvage treatment.
Results: For failed free jejunal transfer, early initiation of oral intake was obtained when another free jejunum was transferred. For failed free soft-tissue transfer for intraoral defects, reconstruction with common free (first choice) or pedicled flaps was used: a voluminous musculocutaneous flap for extensive defects; forearm flap or pedicled pectoralis major flap for intermediate defects, and direct closure for small defects of the oral floor. For failed secondary soft-tissue transfer to improve a certain function, salvage flap transfer was not chosen in the acute setting. For failed secondary maxillary reconstruction, simple reconstruction using the rectus abdominis musculocutaneous flap combined with costal cartilage achieved stable results. The overall success rate of the repeated free flap was 89 percent (eight of nine patients).
Conclusions: When a free flap is judged unsalvageable, surgeons should determine subsequent treatments, considering the success rate as one of the most important factors. The authors believe that simple reconstruction using a common free flap is the first choice in most cases. When regional or general conditions do not permit further free flap transfer or when defects are comparatively small, reconstruction with a pedicled flap or direct closure of the defect may be considered. (*Plast. Reconstr. Surg.* 119: 1223, 2007.)

Over the past decade, free tissue transfer with microvascular anastomosis has progressed and is widely used for the reconstruction of defects following cancer ablation in the head and neck. The reported overall success rates remain at 95 to 97 percent,[1-4] although microvascular skills and instruments have improved. Failure caused by vascular thrombosis is inevitable and frequently leads to devastating results. When vascular thrombosis is detected, prompt surgical reexploration is undertaken to salvage the free flap. However, successful salvage rates have been reported to range from 28 to 87.5 percent,[1,3,5,6] and subsequent salvage reconstruction is required for unsalvaged cases. Salvage reconstruction is generally challenging and difficult because the most suitable flap has already been used in the first reconstruction and the available recipient vessels for microvascular free tissue transfer are limited. The risk of infection and delayed wound healing is high because of inflammation caused by leakage of saliva or digestive juices. Furthermore, repeated operations result in a poor general condition, which does not permit further surgery that involves

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