K. J. Lee: Essential Otolaryngology and Head and Neck Surgery (IIIrd Ed)

Chapter 22: Facial, Plastic, Head and Neck Reconstructive Surgery

I. Basic Information on Flaps and Grafts

Skin Grafts: (Fig. 22-1)

1. Thiersch graft = 0.008 in - 0.010 in.
2. Split-thickness graft = 0.010 in - 0.018 in
3. Dermal graft = dermis only
4. Full-thickness graft = epidermis + dermis.

Thiersch and Split Thickness Grafts

Advantages

1. High percentge of take.
2. Donor site heals without a graft.
3. Gives excellent immediate cover.

Disadvantages

1. No tensile strength.
2. Poor color match.
3. Contraction on healing.
4. Lacks bulk.

Full-Thickness Graft

Advantages

1. Less contracture.
2. Better color.
3. Greater bulk.

Disadvantages

1. Small areas.

2. Poorer take.

Dermal Grafts

Advantages

1. Strong - will take in irradiated tissue.

2. High resistance to infections.

Uses

1. For carotid artery cover following neck dissection in irradiated patients.

2. For pharyngeal suture line cover in irradiated patients.

Physiology of Graft Nutrition

0-12 hours Plasma circulation, nutrition to graft by imbibition of exudate from host bed.

12-24 hours Inosculation - direct connection of graft and blood vessels.

24-48 hours Host vessels grow into graft.

48 hours on Peripheral cellular union of graft and host with epithelialization.

Plasmatic circulation works as follows: The hydrostatic pressure at the capillary end of the skin's capillary-venule glomerulus drives crystalloids through the interendothelial cement substance into the tissues where they become tissue fluid. This tissue fluid flows between the fibers of collagen and elastin, embedded in mucopolysaccharides of the ground substance. To recirculate or to return to the donor circulation, the tissue fluid can do so by lymphatic circulation or by the blood circulatory system directly. An open wound does not havee a plasmatic circulation, and hence the tissue fluid escapes through the portal of the wound and is not recirculated. A wound covered with a skin graft permits restoration of vascular and tissue-fluid balance, returning plasmatic and hemic circulation to normal.

Hemic circulation of the graft depends on capillary buds that grow from the donor towards the graft's circumference by seemingly purposeful orientation. Blood flow can be detected microscopically in new capillary buds by the fourth day.

Once the transplant has a vascular purchase on the host bed, peripheral cellular union of graft and host is accomplished by epithelization. The rate of epithelization is about 0.5 mm/day.

Vascularization and graft take depend on:

1. Healthy host bed with adequate blood supply.

2. Adequate fixation and immobilization.

3. No infection.

4. Graft over bone or cartilage requires intact periosteum or perichondrium.

Causes of failure of graft take:

1. Graft:

a. Tension.

b. Inadequate immobilization.

c. Inaccurate approximation of graft to host bed and the margins.

2. Host bed:

a. Infection.

b. Poor hemostasis (hematoma seroma).

c. Fibrosis of bed.

d. Irradiation of host bed.

e. Lack of perichondrium or periosteum over cartilage and the bone.

Major Flaps in Head and Neck Reconstructive Surgery (Pedicle Flaps)

A. Classification:

1. Forehead.

2. Medially-based chest flap.

3. Laterally-based chest flap.

4. Nape of neck.

B. Definition: Pedicle flp (vascular attachment to the body at all times by transferred tissue).

C. Basic concepts:

1. Based on arterial supply.

2. A flap is an island. The width of the base of the flap is unimportant beyond the necessity to contain a vascular pedicle.

3. Tubing of flap is useful if only the distal portion is used in the transfer (prevents infection and granulation).

4. Delay of flaps:

a. Decision based on need.

b. Will increase chances of survival.

c. Effects dermal and subdermal vessel hypertrophy and hyperplasia with a 7-14 day delay.

d. Allows greater length of flap for use.

5. Transfer of blood supply from graft site distal, useful end of flap - approximately 14 days.

6. Flaps die of congestion, rarely from anemia.

7. The patient's blood pressure, hemoglobin, and hematocrit are vital for flap survival.

8. A clean, well-vascularized bed required for transfer.

9. No tension at suture line.

10. No twisting of pedicle or pressure on pedicle allowed or impairment of flap circulation will occur.

Advantages and Disadvantages of the Flap

1. Capable of carrying tissues other than skin.

2. Carries its own blood supply, therefore, more likely to "take".

3. Less tendency to discolor, more resistant, more elastic, more movable, and less likely to contract. Although a 25% leeway should be kept in mind in the planning of a pedicle flap.

4. More adaptable to weight bearing.

5. Capable of bridging a defect.

6. Can be used on a host bed of questionable nutrition.

7. No pressure dressing necessary.

8. One disadvantage is that it usually needs many stages.

Forehead Flap

Arterial base: Superficial temporal artery and postauricular artery. Note: Flap can be based on scalp vessels should the external carotid be tied in a previous major procedur.

Delay: Rarely necessary but can be achieved by isolation and ligation of the supratrochlear and supraorbital vessels on both sides.

Uses: Buccal cavity, oropharynx, hypopharyngeal reconstruction, chin and neck skin reconstruction.

Methods of entry:

1. Beneath or above the zygoma.

2. Through a cheek incision to the buccal cavity.

Disadvantage: Disfiguring in females (nipple in the neck).

Special uses: A bipedicle bucket handle forehead flap for chin reconstruction.

Donor site: Closed by immediate or delayed skin grafting.

Specific Forehead Flaps

1. Forehead island flap: The flap is based on the supraorbital or supratrochlear artery. It is a full-thickness skin flap with a subcutaneous pedicle carrying the artery. It is transferred subcutaneously and is useed as a full thickness skin graft over the nasal bridge.

2. Indian forehead flap: It is based on the superficial temporal artery. It is used for nasal reconstruction. The disadvantage is a minor cosmetic defect. Closure of the donor site is with a split-thickness skin graft.

3. Median forehead flap: Based on supratrochlear-supraorbital artery, its donor sitee is closed primarily.

Medially-Based Chest Flap

Arterial base: Includes four perforated arteries of the internal mammary artery.

Delay: Advisable. Allows greater length and greater reliability.

Staged delay: Increases length possibilities and reliability.

Uses: Buccal cavity, orohypopharyngeal, and cervical esophageal reconstruction following major head and neck reconstruction. Reliable, particularly following delay.

Donor site: Closed with split-thickness skin graft, immediate or delayed.

Laterally-Based Chest Flap

Arterial base: Acromiothoracic artery.

Delay: Preferable but not necessary. Will increase both length and reliability.

Disadvantages: Disfiguring in females (nipple in the neck).

Uses: Buccal-oral cavity, hypopharyngeal, and laryngopharyngeal recostruction.

Donor site: Covered by split-thickness skin graft, immediate or delayed.

Nape of Neck

Arterial base: Occipital artery.

Delay: Essential.

Uses: Neck skin replacement, cervical esophageal reconstruction, oral cavity and hypopharyngeal reconstruction.

Disadvantges: One of the least reliable of major head and neck flaps.

Donor site: Covered with split-thickness skin graft, delayed or immediate.

The Usee of Flaps and Pharyngostomes in Irradiated Patients

In using flaps for head and neck reconstructive surgery, careful planning is essential. Such planning allows preparation for possible complications. In initial surgery on irradiated patients, discretion is always the better part of valor. It often is desirabl to create a pharyngostome to be sure of adequate carotid coverage and healing before planned reconstruction at a later date. Prepared delayed chest flaps with greater length and reliability prior to definitive surgery decreases the risks of failure of the flap on reconstruction.

Transposed, Advancement, and Interposed Flaps

Definition: Use of local viable tissue to close a defect, with simultaneous staggering of the inevitable scar line.

A. Types:

1. Z-plasty.

2. Simple advancement.

3. Bilobe advancement.

4. V-Y closure.

B. Advantages:

1. Viable graft tissue with excellent blood supply.

2. Tissue close to the defect, subsequently excellent color and texture match.

3. Good scar camouflage.

4. Adequate thickness, hence less contracture.

5. Necrosis rare with correct planning.

C. Disadvantages: Limited by local available tissue.

D. Uses:

1. To correct contracted linear scar.

2. To reposition malposed tissue.

3. To close facial cutaneous defects.

Z-Plasty

A. Definition: Classically, the Z-plasty is based on a Z figure. The central limb and arms are of equal length. The arms are at opposite nds of the central limb and parallel. Therefore, the two angles so formed are equal.

B. Principle:

1. The greater the angle the greater the amount of gain. Inevitably, the greater the angle the more difficult the flap transposition.

2. In general, the 60° Z-plasty is the most widly used, giving good lengthening and a reasonable margin of safety for flap survival.

3. When facd with a long scar revision, multiple Z-plasties are preferable to large Z-plasties.

4. A 60° angle Z-plasty gives a 73% increase in scar length.

C. Uses:

1. To prevnt scar contracture.

2. To change plane of scar.

3. To reposition poorly placed tissue.

4. To remove webbing.

5. To close cutaneous defects.

6. To remove "dog ears".

7. To augment tissue.

8. To correct defects at the commissure of the mouth, eye, etc.

9. To enlarge a constricting tracheostome.

Composite Grafts

A. Definition: Graft which contains two layers of tissue, i.e. skin and cartilage.

B. Uses: Ear, nose, eyelid, and trachea.

C. Principles:

1. Handle with care.

2. Always use sharp instruments when taking a graft.

3. Use no electrocautery to graft or vessel ligation.

4. Never allow the periphery of the graft to be at a greater distance than 1.5 cm from the center. The length is irrelevant.

5. Fine sutures (6-0) when suturing in place.

D. Bed:

1. To have well-nourished recipient site.

2. To have no infection.

Methods of Increasing Graft Survival

1. Cooling of graft to decrease metabolic requirements. This appears to allow increase in size of periphery-to-center of up to 2 cm.

Disadvantages: Edema of graft appears to last for a longer period.

2. Treatment of donor site with histamine dichloride.

3. Galvanic current stimulation to donor site one day before surgery.

Crane Principle

1. Use of pedicle flap of skin and subcutaneous tissue.

2. The bulk of the flap is returned to the donor site leaving the subcutaneous tissue at the graft site.

3. Skin graft is then used to cover the grafted area.

4. Applicable to head and neck surgery for large areas of exposed skull after periosteum has been removed in the treatment of scalp cancers.

II. Myocutaneous Flap

In recent years the myocutaneous flap has become the major method of reconstruction employed by head and neck surgeons. Cadaver dissections and subsequent operative experience have permitted surgeons to better understand and apply the fundamental principles of flap design, muscular and cutaneous circulation, and appropriate indications and limitations of these flaps. As experience has increased and more series published, it has become clear that optimal results are obtained only when strict adherence to fundamental surgical tenets is observed.

Definition

Myocutaneous Flap: A myocutaneous flap is a flap that incorporates as a single unitt muscle and envloping fascia, subcutanenous elements, skin, and vascular suppor. They are axial in design, incorporating a major blood vessel which runs along the entire undersurface and provides perforators to the muscle and skin along its course. A random flap extending beyond the myocutaneous flap can be incorporated providing the subcutaneous tissue and fascia are carried with the overlying skin (Fig. 32-2). Currently, four flaps are used in head and neck reconstruction. These include:

1. Sternocleidomastoid flap (SCM).

2. Trapezius flap (TPZ).

3. Pectoralis major (PM).

4. Latissimus dorsi (LD).

General Considerations Regarding Myocutaneous Flaps

1. The skin overlying the muscle bulk is supplied by both cutaneous arteries and musculocutaneous arteries.

2. Myocutaneous flaps may be used without delay.

3. Myocutaneous flaps add bulk when extirpative surgery has left a large (and often deep) defect.

4. Myocutaneous flaps may be used in a field previously treated with radiation (see 10).

5. The myocutaneous flap may become a "functional flap" as it is employed in esophageal reconstruction.

6. Myocutaneous flaps may be used to transfer underlying bone which can be used for facial reconstruction.

7. Reported epithelial loss in skin paddles has been associated with minimal morbidity; fistulization is uncommon.

8. Myocutaneous flaps can be performed with relative ease by the skilled surgeon.

9. Myocutaneous flaps are readily available and reliable.

10. These flaps may be radiated postoperatively.

Sternocleidomastoid Myocutaneous Flaps

Anatomy

This muscle arises from two heads: a round tendonous head that takes off from the manubrium on its anterosuperior surface and a muscular head from the medial upper third of the clavicle. The anterior cervical triangle fascia splits to envelop the muscle. This is of major importance in conservation surgery. The two heads unite to form a common body which passes superiorly and posteriorly to insert on the mastoid process. Small slips of muscle attach to the superior nuchal line of the occipital bone.

Arterial Supply

1. Occipital artery.

2. Superior thyroid artery.

3. Thyrocervical trunk.

Nerve Supply

1. Accessory nerve: motor.

2. Anterior rami of the second and third cervical nerve: sensory.

SCM Action

1. Extension of the head at the atlanto-occipital joint.

2. Flexion of the cervical vertebrae.

3. Pulls the ipsilateral ear to the shoulder when the face is rotated in the opposite direction.

Operative Technique

1. Outline the paddle of skin to be employed, either superiorly or inferiorly based.

2. Elevate the skin muscle paddle from the deep fascia before performing the neck dissection.

3. Using 3-0 chromic sutures fix the underlying fascia muscle to the skin to avoid avulsion (dermal layer - not epidermis).

4. Rotate the paddle under the mandible to rest it in the defect. NB. There should be no tension at any point.

5. Suture the muscle tip to the wound to anchor the pedicle.

6. Suture the skin margins, again without tension.

7. The donor site is closed primarily, or using a rhomboid rotation flap.

Indications for Usage

A. SCM flap reconstruction of:

1. Tongue.

2. Floor of mouth.

3. Tonsillar fossa.

4. Esophageal patency.

Drawbacks

1. Limited range and size.

2. Variable covering ability secondary to loss of either superior or inferior blood supply.

3. Debate exists as to safety of this flap in conservation neck surgery. However, if the fascia is not violated by tumor, and nodes are "self-contained", the muscle may be used.

4. Partial epithelial loss over skin paddle is common (50%0.

Trapezius

Anatomy

This muscle has a broad base of origin. Fibers originate from the medial third of the superior nuchal line of the occipital bone, the external occipital protuberance, and the ligamentum nuchae. Further, fibers originate from the seventh cervical vertebrae and the spinous and supraspinous ligaments of all the thoracic vertebrae. The muscle fans far out to insert in essentially three bundles. The upper portion directs to the lateral third of the clavicle. The middle third fibers are directed to the acromion process horizontally, and the inferior fibers are directed upward and laterally to insert on the medial end of the spine of the scapula.

Arterial Supply

1. Ascending cervical artery.

2. Transverse cervical artery.

3. Suprascapular artery.

Nerve Supply

1. Spinal accessory nerve.

2. Third and fourth cervical nerve: sensory.

Trapezius Action

The various muscle bundles act in a coordinated effort. Subdivided, the upper fibers elevate the scapula, the middle fibers pull the scapula medially, and the lower fibers pull the medial border of the scapula downward. These efforts assist the serratus anterior muscle in the elevation of the arm.

Operative Technique

1. Positioning is very important. Place the ipsilateral arm across the chest with the side of the chest elevated.

2. Measure the defect carefully. Too much flap is rarely a problem.

3. The distance from the thyrocervical trunk to the defect will indicate the length available.

4. Skin and subcutaneous tissue are incised and trapezius muscle with fascia (including transverse cervical vessels) are elevated. NB: Full thickness of muscle must be elevated since the blood supply enters from the deep surface.

5. Blunt dissection will separate muscle bundles. NB: The venous drainage is superficial and should be well identified and preserved before arterial dissection. The vein (TCV) is found superficial to the omohyoid, while the artery is deep to it.

6. The donor site is undermined and the flap is swung forward. At this point the vascular pedicle to the thyrocervical trunk is the sole point of attachment. HANDLE WITH CARE!

7. The muscle and skin are sutured into place in the defect.

8. The donor site is usually closed primarily.

Indications for Usage

Reconstruction of:

1. Tongue.

2. Floor of the mouth.

3. Lateral pharynx.

4. Hypopharynx.

5. Neck skin (and opposite neck).

6. Mandible and soft tissue.

7. Esophagus.

Drawbacks

1. Sacrifice of the accessory nerve.

2. Bulkiness.

3. Donor site may require a skin graft.

4. Often the base of the flap is too thick for primary intraoral covering and requires a controlled orocutaneous fistula.

Pectoralis Major (PM)

Anatomy

This broad, flat, and fan-shaped muscle has its origin from the medial portion of the clavicle (horizontal fibers), the sternum, and the upper six costal cartilages. The fibers, after reaching maximum span over the chest wall, converge into a large tendon that attaches to the lateral tip of the bicipital groove of the humerus.

Arterial Supply

1. Thoracoacromial artery.

2. Lateral thoracic artery (nondominant).

Nerve Supply

1. Medial pectoral nerve.

2. Lateral pectoral nerve.

PM Action

The PM muscle bundles adduct the arm and medially rotate it. The clavicular fibers assist in the flexion of the arm.

Operative Technique

1. The paddle is outlined on the chest wall along the vascular strip. Place marks on the shoulder tip and xyphoid and join these points. The artery is drawn exiting from under the midportion of the clavicle perpendicular to this line.

2. Skin and subcutaneous tissue is incised along the lateral border of the paddle.

3. Muscle bundles are split and dissection is carried deep to the muscle to avoid injury to the vascular pedicle (include fascia).

4. Using a retractor, elevate the muscle and deep fascia for direct visualization of the neurovascular bundle.

5. Suture deep dermal layers to the underlying fascia with 3-0 chromic suture to avoid avulsion of the flap.

6. As the dissection is carried superiorly, keep the neurovascular pedicle in view at all times.

7. The infraclavicular attachments are separated.

8. The pectoral nerve is cut.

9. The flap is turned over the clavicle and placed in the reconstructive site.

10. The donor site is closed primarily and drained.

Indications for Use

Reconstruction of:

1. Base of tongue/anterior tongue.

2. Floor of mouth.

3. Pyriform sinus.

4. Esophageal defects.

5. Mandible and soft tissue.

6. Temporal bone resection site.

7. Orbital defects.

8. Neck skin defects.

9. Palate.

10. Tonsillar fossa.

Note: Paddle can be divided and folded onto itself to form an inner and outer closure.

Drawbacks

1. Pedicle rests on the clavicle which may cause decrease in vascularity.

2. Bulkiness.

3. Change in chest wall appearance, especially in younger women.

4. McFee's incision is necessary for tunneling flap - this may be hazardous in post-irradiated necks following previous radical neck dissection.

Latissimus Dorsi (LD)

Anatomy

The largest and first utilized of the myocutaneous flaps, this fan-shaped muscle arises from the posterior portion of the iliac crest, the lumbar fascia, and the spines of the lower six thoracic vertebrae (deep to the trapezius). Other muscle bundles arise from the lower three or four ribs and fibers have been recognized from the inferior angle of the scapula. All of these bundles converge to a single tendinous insertion. The tendon wraps around the teres major muscle and inserts to the floor of the bicipital groove of the humerus.

Arterial Supply

1. Thoracodorsal branch from the subscapular artery.

Nerve Supply

1. Thoracodorsal nerve: from the posterior cord of the brachial plexus.

LD Action

This broad, fan-shaped muscle is best appreciated in trained athletes (especially swimmers). It extends, adducts, and medially rotates the arm.

Operative Technique for Latissimus Dorsi Flap

1. Place the patient in a lateral decubitus position.

2. Draw the paddle obliquely along the long axis of the muscle with the lateral border on the lateral margin of the muscle.

3. Initial incision is begun in the upper lateral portion of the flap defining a place between the latissimus dorsi and the serratus anterior.

4. Dissect toward the axilla to identify the neurovascular bundle on the deep surface of the muscle.

5. Once the neurovascular pedicle is identified, free the remaining portion of the designed myocutaneous unit.

NB: Bleeding may be a problem if vessels to the teres major and serratus anterior are not identified and ligated.

6. The deep border of the pectoralis major is appreciated and a tunnel is created between the pectoralis major and pectoralis minor up to the clavicle.

7. The flap is pulled through this tunnel, over the clavicle, and deep to the neck flap.

8. If intraoral use is intended, the flap is directed deep to the mandible.

9. Suture the pectoralis fascia to the latissimus fascia to avoid sliding and potential compromise of the vascular pedicle.

Indications for Use

Reconstruction of:

1. Intraoral defects.

2. Intraoral and extraoral combined defects.

3. Temporal bone resection.

4. Orbital defects.

5. Nasal defects.

6. Scalp defects.

7. Frontoethmoid defects.

Drawbacks and Disadvantages

1. Requires change in patient position to reach the donor site.

2. The flap is tunneled through an area of the anterior chest wall which may be used as a donor site.

3. Attempts to incorporate rib (ninth) may lead to pneumothorax. NB: Any

myocutaneous flap placed in a heavily irradiated field may break down at the point of attachment of the skin paddle and the radiated tissue. This, however, rarely has required surgical correction.

Complications of Myocutaneous Flaps

1. Loss of flap due to disruption of the vascular pedicle.

2. Loss of random skin flap (island) attached to an axial myocutaneous flap.

3. Skin slough.

4. Separation of suture line.

5. Infection: donor and recipient site.

6. Fistulae.

7. Flap too small to fill defect. NB: Most flaps that appear bulky initially after surgery, with the nerve cut, will shrink as the muscle atrophies (6-9 months).

8. Loss of muscle form and function from donor site.

9. Hematoma at the donor site: should be drained using Hemovac.

III. Cosmetic Surgery

Blepharoplasty

Preoperative Evaluation

1. Minimal ophthalmic evaluation includes visual acuity with a Snellen's eye chart, ocular motility, and ocular tension by palpation. In patients who have had previous eye disease or systemic disease suggesting retinal pathology an ophthalmology consultation is mandatory.

2. Upper lid:

a. Amount of redundant skin of the upper eyelid and inequality between each upper eyelid should be noted and mentioned to the patient. At the same time, hooding and brow ptosis should be evaluated and identified for the patient, counseling them that a blepharoplasty may not correct hooding and may exacerbate brow ptosis.

b. The eyelid crease from the supratarsal fold must measure 7-10 mm above the eyelash margin. If this crease in the central part of the eyelid is less than 7 mm above the lash margin, consideration must be given to performing an upper lid fixation blepharoplasty.

c. The presence or absence of fat in the medial and pretarsal compartments is

evaluated for subsequent removal at surgery.

d. A bulge in the lateral upper eyelid usually is due to ptosis of the lacrimal gland.

3. Lower lid:

a. The pinch test to evaluate tonicity of the lower lid is performed by pulling the lower lid from the globe and observing its return to the original position. If the lid settles back and does not snap back, then consideration must be given to performing a lid-shortening procedure.

b. The presence or absence of scleral show and inequality between scleral show of each lower lid is mentioned to the patient if it should exist preoperatively. Should an inequality exist postoperatively, the patient will have been prepared for this particular cosmetic result.

c. The presence of pseudo-herniated fat in the three compartments of the lower lid is elevated by having the patient elevate the eyes and look superiorly. Palpation of the globe and observation of the transmitted pulse through the pseudo-herniated fat also will identify the fat that must be removed.

4. A four-lid blepharoplasty will not correct brow ptosis, hooding, or crows'-feet.

Surgical Procedures

Upper Lid

1. The lower incision is made in the supratarsal fold and may run laterally in a crow's-foot a distance of not more than 15-20 mm from the lateral canthus. Preferably it should lie within the margin of the bony orbit.

2. The upper incision lies at the junction in the change in texture of the upper eyelid skin and brow. Pinching the skin to be excised along the proposed incisions will help prevent injudicious skin excision and postoperative lagophthalmos.

3. Thick upper eyelids are treated by removing a strip of the orbicularis muscle that may be as wide as the width of skin excised. Fat is then removed from the pretarsal and medial pockets. The fat of the medial pocket is whiter and of different consistency than the pretarsal fat.

4. A bulge in the lateral quadrant of the upper eyelid is due to a ptotic lacrimal gland. The fullness may be corrected by suturing the lacrimal gland with a 5-0 clear nylon suture to the periosteum of the lacrimal fossa.

Aponeurosis Fixation Upper Lid Blepharoplasty

1. Indications:

a. Males.

b. Young females 45 or younger with thick skin.

c. Somtimes in middle-aged females 45-60.

d. Never in elderly females.

2. Preoperative counseling must include information about transient ptosis and difficulty looking upward for up to 3 months after surgery.

3. The upper incision is made 12 mm above the lash line in the central part of the lid in females, and 10 mm above the lash line in males. After opening the septum and removing the preaponeurotic fat, the levator aponeurosis is identified. The orbicularis oculi muscle is then trimmed flush with the skin of the lower eyelid incision and is not resected below the skin margin. Five to seven sutures of 6-0 clear nylon are made through the orbicularis oculi muscle and levator aponeurosis. The skin is then closed with a running suture.

4. Extreme care must be paid to marking and creating equal and symmetrical supratarsal folds.

Lower Lid Blepharoplasty - Skin Flap

1. Indicated in patients with excessive skin laxity. An incision is made 2 mm below the lash line and is carried laterally in a crow's-foot to the bony orbital margin.

2. A minimum of 5 mm of skin must lie between the upper and lower eyelid incisions to prevent webbing and flap edema.

3. The skin is redraped and the patient is asked to open the mouth and look upward as the skin is redraped to the new concavity of the lower eyelid following fat removal. After marking out the amount of skin to be excised, slightly less than the expected amount of skin excision should be carried out to reduce the likelihood of a postoperative ectropion.

Lower Lid Blepharoplasty - Skin Muscle Flap

1. This operation is useful for patients with pseudo-herniated fat and relatively smooth lower eyelid skin.

2. The incision is made as before, 2 mm below the lash line, and laterally carried down to the periosteum of the orbit. The orbicularis muscle is separated by blunt dissection from the soft tissues of the orbit. The skin muscle flap is separated from the previous skin incision with scissors beveled to preserve the tarsal plate and lash follicles. Gentle pressure on the globe will reveal the pockets of fat that need to be resected. Following resection of the

orbital fat, the skin muscle flap is redraped and again the patient is asked to open the mouth widely and look upward as the flap is repositioned prior to marking for excision. After excision of the full thickness skin and muscle, a second 1-2 mm of orbicularis oculi muscle is removed from the skin flap to prevent postoperative bulging of the muscle along the suture line.

Complications

Serious complications following blepharoplasty are rare.

Hematoma

1. Usually clears in time.

2. If clot liquefies, drainag through a small stab incision and milking the clot will suffice.

3. Large hematomas with loss of visual acuity will produce deep unilateral eye pain. This must be handled with immediate removal of sutures from the incision to facilitate decompression of the orbit.

a. Immediate ophthalmology consultation.

b. 2 g mannitol IV, and IV acetazolamide (Diamox).

c. May develop up to 1 week after surgery, but usually have been repaired within 12-24 hours after surgery.

d. Incidence is 1:25,000-50,000 cases.

e. There has been one reported case of bilateral blindness.

Milia

1. Most frequent complication.

2. They develop along the suture tracks and are treated by pinpoint cautery or marsupialization with a 25 gauge needle.

Lagophthalmos

1. Inability to completely close the eyes is relatively common for a period of several weeks following blepharoplasty. As the lids and brows gradually settle, this usually resolves spontaneously.

2. Severe lagophthalmos with corneal drying is due to overzealous excision of the upper eyelid skin and should be treated with a full-thickness skin graft.

Ectropion

1. Minimal eversion of the lower eyelid skin is also relatively common following lower lid blepharoplasty and will resolve as the edema and induration subside within the first week or two following blepharoplasty.

2. Severe ectropion due to scarring or overzealous excision of the lower eyelid is treated conservatively for several months with taping and forceful eyelid closure.

a. If the ectropion fails to resolve, full-thickness skin graft from the upper eyelid skin (if sufficient quantities exist) is the donor site of choice.

b. Full-thickness skin grafts from the postauricular area and supraclavicular fossa provide the next best texture and tissue match for the lower eyelid skin.

c. A horizontal lid shortening procedure with skin grafting may be necessary to correct the ectropion in atonic lids.

Blindness

1. This complication almost always follows fat removal and occurs in 1:25,000-1:50,000 cases.

2. Postoperative instructions should include frequent checking of the visual acuity by patient, nurses, and family.

3. If the patieent complains of deep, unilateral eye pain that is similar to the pain produced with teasing the fat from the orbit, the surgeon should be notified immediately.

4. Sudden onset of pain and blindness has been reported up to 5 days following a blepharoplasty. Therefore, the patient should be instructed to rest and recover from surgery without returning to normal activities for a minimum of 2 weeks.

Hooding of the Lateral Canthus

1. Develops when the upper and lower eyelid incisions are too close together.

2. The incisions should be separated by at least 5 mm.

Dry Eye

1. Blepharoplasty may exacerbate a preexisting lacrimal disorder.

2. Schirmer's testing preoperatively will identify those patients who should have a conservative skin excision of the upper eyelid skin.

Facelift

Preoperative Evaluation

A. The facelift operation needs to be tailored to the pathologic anatomy causing the cosmetic deformity for which the patient seeks consultation.

B. A preoperative classification of the cervical area enables the surgeon to tailor the operation to each patient.

1. Class I is a patient with minimal cosmetic deformity who should either be advised against having cosmetic surgery or may have a "prophylactic" facelift with skin undermining to maintain the present visage.

2. Class II is a patient with skin laxity only. Treatment involves wide undermining and plication of the subcutaneous muscular aponeurotic system (SMAS) and posterior border of the platysma muscle.

3. Class III patient has excessive fat in the submandibular and/or submental areas that require sculpturing.

a. A submental incision is required.

b. Submental lipectomy which is removal of fat deep to the platysma muscle in the submental triangle to expose the mylohyoid muscle should be done very carefully to avoid the hollowed-out appearance in the submental area. Fat usually is removed on top of the platysma and between its medial borders.

c. Removal of fat deep to the platysma muscle any distance from the midline increases the likelihood of injuring the marginal branch of the facial nerve.

4. Class IV is the patient with anterior banding of the platysma muscle that is either present in repose or accentuated by voluntary contraction.

a. Plication, excision, and creation into flaps of the medial borders of the platysma muscle will remove this stigmata of the aging neck.

b. Complete horizontal sectioning of the platysma muscle at the level of the hyoid bone, or lower, is advocated by some to create a sling of the platysma muscle as it is sutured in the midline and created into flaps and sutured posteriorly along its posterior border to the sternocleidomastoid fascia.

1) Complete horizontal sectioning of the platysma muscle, if done at a level higher that the hyoid bone, may result in rolled-up borders of the platysma muscle which are difficult to camouflage.

2) The platysma muscle may be safely sectioned by first undermining it and then squezing the muscle with the hemostat prior to clamp closure while observing the corner of

the mouth. If no movement occurs, sectioning below the clamp after it is closed will prevent injury to the mandibular branch of the facial nerve.

c. Ptosis of the submaxillary glands may be accentuated and increased by complete horizontal sectioning of the platysma muscle.

d. Plication of the medial borders of the platysma muscle with a permanent buried suture will not only give support to the submental area but will prevent the hollowed-out appearance in the submental area whn a submental lipectomy has been done.

5. Class V neck is the patient with acquired retrognathia or congenital microgenia who needs a chin implant at the same time as the cervical facial rhytidectomy.

a. The implant may be placed through the submental incision.

b. The increase in projection of the pognion will greatly enhance the postoperative cosmetic result and the cervicomental contour.

6. Class VI is the patient with a low-lying hyoid bone.

a. Ideally the hyoid bone should lie at or above the fourth cervical vertebra.

b. Preoperative identification of this patient will enhance preoperative counseling to warn the patient of a less-than-optimum postoperative cervicomental contour.

C. Patients who are heavy smokers should have a conservative operation as they tend to bleed, heal poorly, and are susceptible to skin slough.

D. The facelift operation will improve the lower third of the face and upper one-half of the neck. It will not improve the nasolabial fold area.

Operative Technique

A. The facelift operation is basically divided into four flaps: temporal, preauricular, cervical, and postauricular.

1. These flaps are at different levels with temporal and occipital flaps being deep to preserve the hair follicles while the preauricular and cervical flaps are superficial to the SMAS.

B. The danger zone are where vital structures may be injured.

1. The zygomaticotemporal branch of the facial nerve begins to run very superficially over the zygomatic arch and runs in a line from 0.5 cm below the tragus diagonally to a point 1.5 cm lateral to the eyebrow.

a. Elevation of the temporal flap anterior to the hairline must be deep to the frontalis muscle and on top of the periosteum to avoid injury to the superficial level of the temporal

nerve.

b. Below the zygomatic arch, elevation of flaps to the lateral canthal area are possible, but must be superficial to the SMAS to avoid injuring the nerve.

2. The marginal mandibular branch of the facial nerve lies in the fascia of the submaxillary gland. At the level of the notch in the mandible for the facial artery and vein, the nerve begins to course superiorly to, and subsequently lie above, the horizontal ramus of the mandible deep to the platysma muscle.

a. Posterior to the notch of the facial artery there is a relatively thick cushion of tissue protecting the facial nerve and its branches.

b. Anterior to the notch of the facial artery, the nerves run much more superficially beneath the SMAS and the platysma muscle.

3. The greater auricular nerve lies 6.5 cm below the sternal meatus of the ear in the midportion of the sternocleidomastoid muscle.

a. As dissection begins posteriorly and runs over the sternocleidomastoid muscle, dissection must be superficial to leave the fascia overlying the sternocleidomastoid muscle intact to protect the greater auricular nerve.

b. Severing this nerve will result in a numb ear postoperatively and if recognized at surgery should be reanastomosed and buried in the sternocleidomastoid muscle to prevent neuroma formation.

C. The conservative or minimally undermined facelift.

1. Flap elevation is limited to 2.0-2.5 cm.

2. Ethibond 2-0 sutures are used to plicate the SMAS and posterior border of the platysma muscle posterosuperiorly on the perichondrium of the tragus and fascia of the sternocleidomastoid muscle.

3. The skin flaps are then redraped and trimmed with slightly more tension than allowed with wider undermining since the flaps have such an excellent blood supply.

4. This technique has fewer complications with bleeding, skin slough, and nerve damage.

5. Patients who have a class III, IV, or V neck will require submental and submandibular sculpturing in addition to the minimally undermined facelift to adequately correct the cosmetic deformity.

D. The widely undermined facelift.

1. Flap elevation and undermining may be extended to the nasolabial folds and

connected to the undermining in the submental area.

2. The SMAS and posterior border of the platysma muscle are either plicated posterosuperiorly with buried 2-0 Ethibond sutures or the SMAS is excised beginning 1 cm below the zygomatic arch and 1 cm in front of the tragus and carried inferiorly to connect with the platysma muscle.

a. Following elevation of the SMAS layer to the anterior border of the parotid, the flap is redraped posterosuperiorly, trimmed, and then sutured to the pretragal and postauricular fascia with 4-0 Mersilene and/or 4-0 Dexon sutures.

3. When indicated, fat is removed along the inferior border of the mandible on top of the platysma muscle to define the horizontal ramus of the mandible.

a. Patients who have an ill-defined platysma muscle must be handled conservatively to prevent damage to the mandibular nerve.

b. Obese individuals who require submental and submandibular sculpturing will require tapering of the fat excision in the inferior aspect of the neck to prevent a sharp cutoff.

4. The skin flaps then are redraped in a posterosuperior direction that is parallel to a line drawn from the tragus to Darwin's tubercle.

5. Excessive tension on the flaps must be avoided in these widely undermined facelifts to prevent ischemia and skin necrosis.

6. If a submental incision is used, little if any skin is excised since the skin is redraped superiorly and is under marked tension.

a. The submental incision is placed posterior to the first submental crease, but not any lower than the hyoid bone.

b. The witch's chin deformity with a ptotic chin may be alleviated by elevating the skin from the first submental crease and filling the area with a fat flap.

Complication

Hematoma

1. The incidence of hematoma varies from 3.0-15.9%.

a. Major hematomas requiring evacuation occur approximately 3-4% of the time.

b. Minor hematomas that will resolve spontaneously or require aspiration may run as high as 15% in selected series.

c. The average incidence of hematoma formation is 7%.

2. The diagnosis of hematoma is based upon unilateral facial pain, swelling, and buccal ecchymosis.

a. When suspected, immediate removal of the dressing and inspection of the flaps is mandatory.

b. When diagnosed, the sutures are removed immediately to take tension off the skin flaps and the clot extracted.

1) Major hematomas will require general anesthesia and return of the patient to the operating room.

2) Minor hematomas may be managed by intravenous sedation and irrigation of the wound with normal saline until clear.

Skin Necrosis

1. The incidence of large and small skin necrosis may run as high as 25%, but usually is reported to occur in 1-3% of the cases.

2. The most common site is postauricular due to excessive tension on the flaps.

3. WHen diagnosed, conservative therapy without excision is the treatment of choice as the wound will contract and most often give a satisfactory cosmetic result.

4. When wide scars or large areas of skin slough persist, serial scar excision will adequately handle the cosmetic deformity. Skin grafting rarely is required.

Nerve Injury

1. The most frequently injured nerve is the greater auricular nerve.

a. If the patient develops delayed postoperative pain due to severance of the greater auricular nerve, re-exploration and anastomosis of the severed ends frequently will alleviate the trigger-type pain.

b. Immediate, severe postoperative auricular pain may be due to plication sutures that lie in or across the greater auricular nerve and usually will resolve in 6-8 weeks.

Infection

1. The excellent vasculature of the face fortunately makes this an unusual complication.

2. It has been reported with a slightly higher incidence with Penrose drains as opposed to suction drains.

3. Treatment with incision and drainage and appropriate antibiotics usually will resolve

the infection without serious sequelae.

Auricular Deformities

1. Excessive tension on the lobule at closure will result in a "pixie ear".

2. Correction of this deformity is managed by redraping the skin superiorly in front of and behind the ear so that the lobule hangs free.

Submental Depression

1. Injudicious removal of fat deep to the platysma muscle may leave the cobra deformity.

2. A layer of fat left on the skin flap will prevent this from developing and plication of the anterior borders of the platysma muscle similarly will avoid the sunken look.

Alopecia

1. Superficial undermining of the flaps in the temporal and postauricular area will damage the hair follicles.

2. Excessive tension on these flaps will result similarly in hair loss.

3. Male patients must be told preoperatively that the sideburns will be reduced in width as the incision is made halfway between the tragus and hair-bearing skin of the face. In addition, they must be told they will have to shave behind their ears postoperatively.

4. When large areas exist, hair transplantation or localized advancement flaps will correct the bald areas.

Scar Revision

General Principles

A. Relaxed skin tension lines (RSTL) and their direction is of paramount importance in the revision of linear scars.

1. The RSTL are different from Langer's lines which are the lines of skin tension in rigor mortis. Langer's lines in a living person are found when the supine position is assumed with the extremities in extension.

2. Relaxed skin tension lines are the grooves and ridges that follow the direction of the greatest pull in a relaxed attitude, hence these may be different from Langer's lines.

3. When the body is placed in a relaxed attitude, the skin tension will follow only one specific direction, that of the RSTL direction.

a. Relaxed skin tension lines are similar to wrinkle lines in most, but not all instances.

b. Wrinkle lines are influenced by muscle pull.

c. Muscle pull may accentuate the relaxed skin tension lines by relaxing the skin perpendicular to them or it may produce folds that do not follow the RSTL.

4. The long axis of excision of tissue should followe the RSTL.

5. The RSTL can be found by relaxing the skin of the region.

a. Passive manipulation by pinching the skin will form ridges and furrows that extend for a greater distance in the direction of the RSTL than they do when a similar maneuver is made at angles to the RSTL.

b. Pinching in the wrong direction will result in distorted crumpling.

6. The RSTL in body apertures (the ear, nose, mouth) extend perpendicularly or radially from their centers.

B. A scar reaches maturation ion 9-12 months.

1. An incision that is sutured will reach its maximum breaking strength at six weeks.

2. While the strength of the wound will not change after 6 weeks, there is a continual degradation and synthesis of collagen in the scar as the tension of the wound edges determines the width and thickness of the scar that subsequently develops.

3. Therefore, revision of scars should not be undertaken prior to a minimum of 6 months, and preferably 1 year to allow complete maturation.

Operative Technique

Simple Excision with Fusiform Revision

1. Scars no longer than 2 cm in length.

2. Scars that run along the RSTL.

3. Beveling of the incision away from the wound as it extends to the deeper layers will aid in subsequent eversion of the wound edges on closure.

a. A permanent, nonabsorbable suture of 5-0 clear nylon placed through the dermis to evert the skin edges by closing the dermal layer will guarantee the edges of the wound to be approximated without tension for several weeks or months.

b. A subcuticular 6-0 nylon suture that approximates the everted skin edges will yield maximum cosmetic result.

c. Interrupted sutures that are removed in 3-5 days to prevent permanent suture marks also will give a satisfactory result.

Serial Excision of Wide Scars

1. This method involves resecting a wide scar or lesion or skin graft in stages.

2. The area to be excised is reduced with each stage excision until a satisfactory linear scar remains.

3. This method takes advantage of the elasticity of the skin and subsequent stages are planned at 3-6 month intervals when clinically indicated.

W-Plasty and Zigzag Plasty

1. Linear scars over 2 cm in length that do not lie in the relaxed skin tension lines may be conspicuous because the eye as it perceives a long scar is able to follow its direction and predict its course.

a. By breaking up a long scar into short, broken-line closures, the eye is not able to follow these breaks and the scar is thus camouflaged.

2. The W-plasty is the simplest of the broken-line closure techniques.

a. Small triangular flaps are incised on each side of the scar so that they interdigitate following excision and subsequent closure.

b. The sides of the individual triangular flaps should not be longer than 6.5 mm and the base no wider than 6 mm.

c. All incisions are made at right angles to the skin.

d. Undermining of the skin is made so that the thickness of the flaps at the tip is the same as the base.

e. Subcutaneous and intradermal interrupted sutures are used to close the dead space and to relieve tension on the skin suture line.

f. Small, half-buried mattress sutures secure the tips of the flaps to their receptor angles.

3. A zigzag-plasty.

a. In addition to the W-plasty described, small rectangles and squares mixed between the triangles of the W-plasty will break the continuity of the triangle.

b. Rectangles and squares on one side correspond with those in size on the opposite side of the skin to allow them to interdigitate when advanced at closure.

c. Because of the marked irregularity of the closure line, a better camouflage is obtained.

d. Flaps of the zigzag-plasty should not be larger than 4-5 mm and are readily made with a number 11 knife blade.

e. Undermining and wound closure is similar to the W-plasty.

Z-Plasty

1. A type of transposition flap.

2. The Z-plasty consists of a central limb with arms extending from each end in opposite directions, forming an angle with a central limb of 60° or less.

3. The central limb in both arms are of equal length.

4. Two triangular flaps are created which when transposed result in a change of the direction of the central limb and a redistribution of tension.

5. The change of direction depends upon the size of the angles of the Z-plasty.

a. If both angles of the Z-plasty are 60°, the central limb will rotate 90° when the flaps are transposed.

b. The smaller the angle of the Z-plasty, the smaller the rotation of the central limb.

6. To predict the direction of the central limb after transposition, an imaginary line connecting the ends of both arms to the Z-plasty is made.

7. The correct direction for the arms of the Z-plasty would be one that parallels the tension lines.

8. The advantages of the Z-plasty over the broken line closures.

a. It can release or prevent linear scar contractions.

b. It can change the long axis of the scar.

c. It can redistribute tension in an area.

d. It uses all available tissue.

9. The primary disadvantages of a Z-plasty.

a. It increases total scar length 200%.

b. The tip areas of the triangle or flaps tend to become depressed.

c. The angles tend to elevate causing differences in contour of the wound edges.

10. The W-plasty, zigzag plasty and other broken line closure techniques give better results than the Z-plasty for most facial scars.

Ancillary Procedures for Scar Revision

1. Dermabrasion.

a. Minor elevations or depressions along incision lines may be corrected by superficial dermabrasion.

2. Shave excision with a razor blade to "plane" the skin also may be used to revise minor elevations and depressions.

3. Collagen injections subsequently may prove to be another tool in the armamentarium for correcting and augmenting small irregular depressions.

4. Hypertrophic scars and keloids are treated with intralesional steroids of 10 mg/mL.