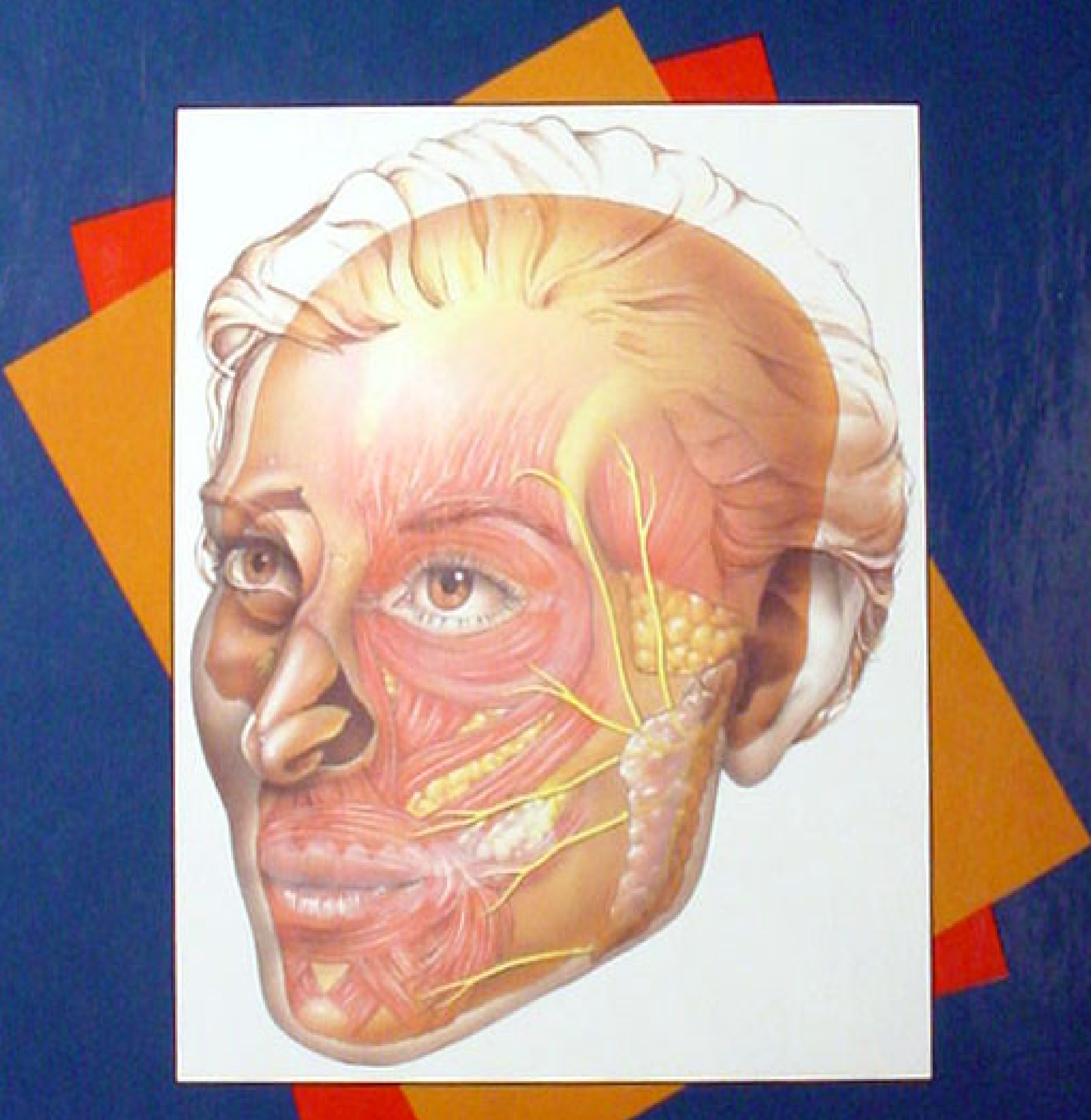
Surgical Approaches to the Facial Skeleton



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Preface

Many reasons exist for exposing the facial skeleton. Treatment of facial fractures, management of paranasal sinus disease, esthetic onlay and recontouring procedures, elective osteotomies, treatment of secondary traumatic deformities such as enophthalmos, placement of endosteal implants, and a host of other reconstructive procedures require approaches to the facial framework. Many approaches to a given skeletal region are possible. The choice is usually based on the surgeon's training, experience, and bias. This book does not advocate one approach over another, although the advantages and disadvantages of each approach are listed. We maintain the age-old belief that "many roads lead to Rome." Thus, the purpose of this book is to describe in detail the anatomic and technical aspects of most of the commonly used surgical approaches to the facial skeleton. We purposely do not present every approach because many are not universally used, or are so simple that nothing needs be said. The approaches presented in this book, however, allow the surgeon complete access to the craniofacial skeleton for any skeletal procedure that is being performed.

We have attempted from the beginning to make *Surgical Approaches to the Facial Skeleton* different from other books that touch on this subject. Most books that discuss surgical approaches do so in the context of the surgical procedure being presented. For instance, a book on facial fractures usually presents surgical approaches to a particular fracture. The surgical approach, however, is not generally given much consideration or presented in sufficient detail for the novice. One is often left with the question, "How did the author get from the skin to that point on the skeleton?" We avoid consideration of why one is exposing the skeleton, and describe the approaches in great detail so that the novice can safely approach the facial skeleton by following our step-by-step description.

This book assumes that the reader has some basic understanding of regional anatomy, especially osteology. The anatomic structures of greatest interest are discussed for each surgical approach. The book also assumes that the reader has developed skills for the careful handling of soft tissues. We have suggested the use of instruments that we have found useful for incising, retracting, and manipulating the tissues involved with each surgical approach, recognizing that others are also appropriate. The book also assumes that the reader is skilled in facial soft tissue closure. We do not discuss skin closure techniques associated with the approaches unless they differ from routine skin closures.

This book contains 14 chapters, 13 of which describe a specific surgical approach. The first chapter discusses basic principles involved in surgical approaches. The remaining 13 chapters are organized into sections, based predominantly on the region of the face being exposed. Often more than one surgical approach is presented for each region, with the choice left to the surgeon. We attempt to point out the advantages and disadvantages of each as it is presented.

We hope that *Surgical Approaches to the Facial Skeleton* will become a helpful companion, especially to surgeons in training, but also as a ready reference to others.

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SECTION I

GENERAL PRINCIPLES FOR APPROACHES TO THE FACIAL SKELETON

1 General Principles For Approaches To The Facial Skeleton

Maximum success in skeletal surgery depends on adequate access to and exposure of the skeleton. Skeletal surgery is simplified and expedited when the involved parts are sufficiently exposed. In orthopedic surgery, especially of the appendicular skeleton, a basic rule is to select the most *direct* approach possible to the underlying bone. Thus, incisions are usually placed very near the area of interest while major nerves and blood vessels are retracted. This involves little regard for aesthetics, allowing the orthopedics surgeon greater leeway in the location, direction, and length of the incision.

Surgery of the facial skeleton, however, differs from general orthopedics surgery in several important ways. First, the primary factor in incision placement is not surgical convenience but facial esthetics. The face is plainly visible to everyone, and a conspicuous scar may create a cosmetic deformity that can be as troubling to the individual as the reason for which the surgery was performed. Cosmetic considerations are critical in light of the emphasis that Western society places on facial appearance. Thus, as we will see in this text, all of the incisions used on the face must be placed in inconspicuous areas, sometimes very distant from the underlying osseous skeleton on which the surgery is being performed. For instance, placement of incisions in the oral cavity allows superb exposure of much of the facial skeleton with a completely hidden scar.

A second factor that differentiates incision placement on the face from that anywhere else on the body is the presence of the muscles and nerve (cranial nerve VII) of facial expression. The muscles are subcutaneous structures, and the facial nerve branches that supply them can be traumatized if incisions are placed in their path. This can result in a “paralyzed” face, which is not only a severe cosmetic deformity but can have great functional ramifications as well. For instance, if the ability to close the eye is lost, corneal damage can ensue, affecting sight. Thus, placement of incisions and dissections that expose the facial skeleton must ensure that damage to the facial nerve is unlikely. Many dissections to expose the skeleton require care and electrical nerve stimulation to identify and protect the nerve. Approaches using incisions in the facial skin must take into consideration the muscles of facial expression. This is especially important for approaches to the orbit, where the orbicularis oculi muscle must be traversed. Closure of some incisions also affects the muscle of facial expression. For instance, if a maxillary vestibular incision is closed without proper reorientation of the perinasal muscle, widening of the nasal base will occur.

A third factor in facial incision placement is the presence of many important sensory nerves exiting the skull at multiple locations. The facial soft tissues have more sensory input per unit area than soft tissues anywhere else in the body. Loss of this sensory input can be a great inconvenience to the individual. Thus, the incision and approaches used must attempt to spare the sensory nerves from injury. An example is dissection of the supraorbital nerve from its foramen/notch in the coronal approach.

Other important factors are the age of the patient, existing unique anatomy, and patient expectations. The age of the patient is important because of the possible presence of the wrinkles that come with age. Skin wrinkles serve as a guide and offer the surgeon the opportunity to place incisions within or parallel to them. Existing anatomic features unique to the individual cal also facilitate or hamper incision placement. For instance, pre-existent lacerations can be used by themselves or extended to provide surgical exposure of the underlying skeleton. The position, direction, and depth of a laceration are important variables in determining its utility. The presence of old scars may direct incision placement; the old scar may be excised and used to approach the skeleton. On other occasions, an old scar may not lend itself to use and may even cause the new incision to be placed at a position that will avoid it. Hair distribution may also direct the position of incisions. For instance, the incision for the coronal approach is largely determined by the position of the hairline. Ethnic characteristics also have a bearing on whether or not an incision will be placed in a conspicuous area. History or ethnic propensity for hypertrophic scarring, keloid formation, and hyper- or hypopigmentation may alter the decision as to whether or where to place an incision.

The pacient's expectations and wishes must always be considered in any decision made about incision location. For instance, patients who repeatedly require treatment for facial injuries may not be concerned with local cutaneous approaches to the naso-orbito-ethmoid region, whereas other individuals may be very concerned. Therefore the choice of surgical approach depends at least partly on the patient.

PRINCIPLES OF INCISION PLACEMENT

Incision placed in areas that are not readily visible, such as within the oral cavity or far behind the hairline, are not of esthetic concern. Incisions placed on exposed surfaces of the face, however, must follow some basic principles so that the scar will be less conspicuous. These principles are outlined in the following text.

Avoid Important Neurovascular Structures

Although this is an obvious consideration, placement of incisions to avoid anatomic hazards is a secondary consideration in the face. Instead, placing the incision in a cosmetically acceptable location takes priority. Important neurovascular structures encountered during the dissection must deal with by dissecting around them or retracting them.

Use as Long an Incision as Necessary

Many surgeons have a tendency to use short incisions. If the soft tissues around a short incision must be stretched to obtain sufficient exposure of the skeleton, the additional retraction trauma may create a less satisfactory scar than a longer incision. A well-placed long incision may be less perceptible than a short incision that is placed poorly or requires great retraction. A long incision heals as quickly as a short one.

Place Incision Perpendicular to the Surface of Nonhair-bearing Skin

Except in some very specific regions, an incision perpendicular to the skin surface permits the wound margins to be reapproximated in an accurate, layer-to-layer fashion. Incisions performed obliquely to the surface of the skin are susceptible to marginal necrosis and overlapping of the edges during closure. Incisions in hair-bearing tissue, however, should parallel the direction of the hair so that fewer follicles are transected. An oblique incision requires a more meticulous closure because of the tendency of the margins to overlap during suturing. Subcutaneous may have to be placed more deeply to avoid necrosis of an oblique edge overlap

Place Incisions in the Line of Minimal Tension

The lines of minimal tension, also called relaxed skin tension lines, are result of the skin's adaptation to function and are also related to the elastic nature of the underlying dermis (Fig. 1-1). The intermittent and chronic contraction of the muscles of facial expression create depressed

Figure 1- 1 - lines of minimal tension (released skin tension lines) are very conspicuous in the aged face. These lines of creases are good choices for incision placement because the scars resulting from the incision are imperceptible.

creases in the skin of the face. These creases become more visible and depressed as one ages. For instance, the supraorbital wrinkle lines and the transverse lines of the forehead are caused by the contraction of the frontalis muscles, which insert into the skin of the lower forehead. In the upper eyelids, many fine perpendicular strands of fibers of the elevator aponeurosis terminate in the dermis of the skin an along the tarsus to form the supratarsal fold. Similar insertions in the lower lid create fine horizontal lines, which are accentuates by the circumferential contraction of the orbicularis oculi muscle.

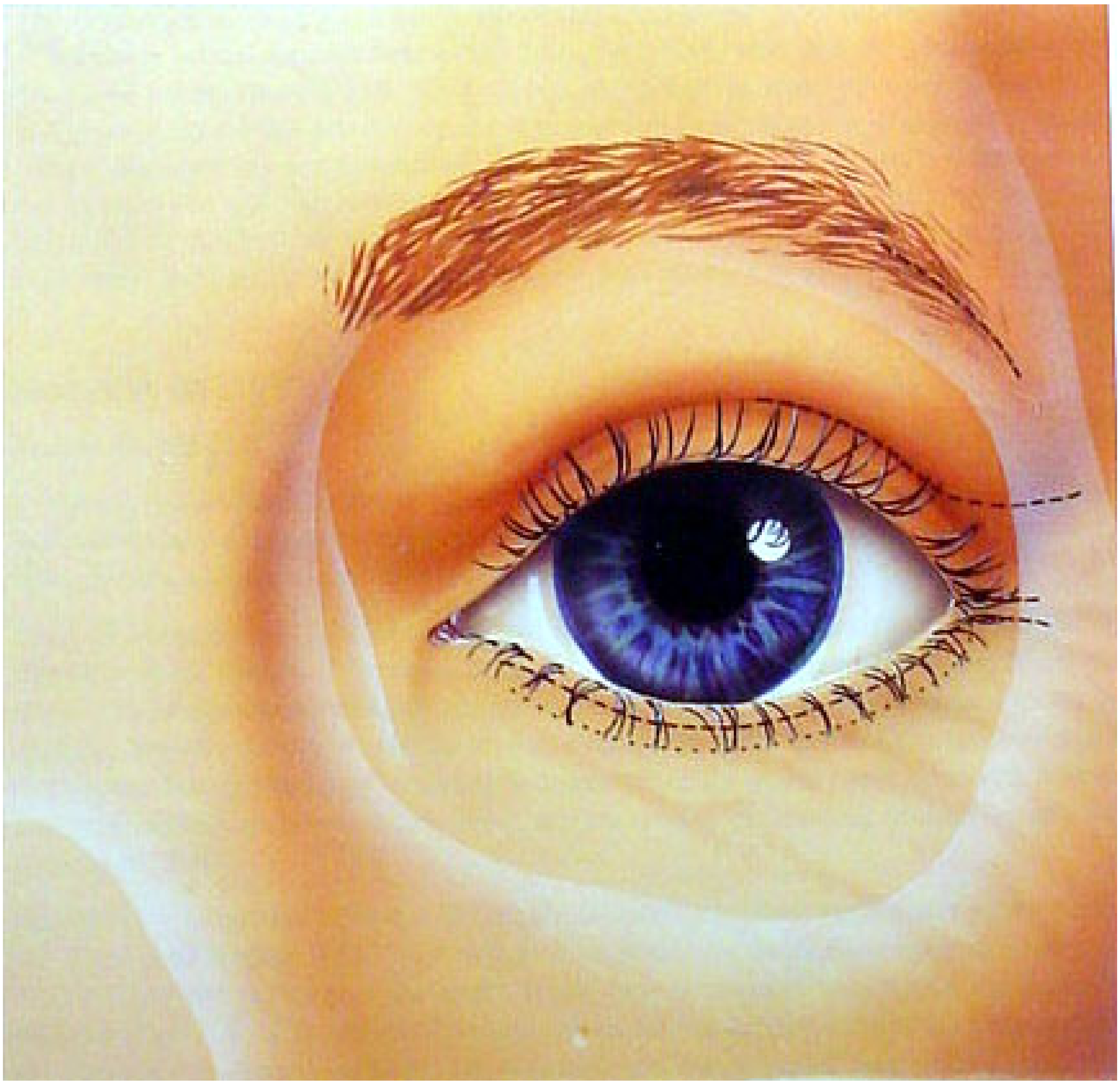
Incision lines should be made within the lines of minimal tension. Incision made in or parallel to such a line or crease will become inconspicuous if careful closure is performed. Any incision or portion of an incision that crosses such a crease, however, is often very conspicuous.

Seek for Other Favorable Sites for Incision Placement

If incision cannot be placed in the lines of minimal tension, they can be made inconspicuous by placement inside an orifice such as the mouth, nose, or eyelid; within hair-bearing areas or location that can be covered by hair; or at the junction of two anatomic landmarks such as the esthetic units of the face.

SECTION

II PERIORBITAL APPROACHES



A standard series of incisions has been used extensively to approach the inferior and lateral orbital rims. Properly placed incisions offer excellent access with minimal morbidity and scarring. The most commonly used approaches are those made on the external surface of the lower eyelid, the conjunctival side of the lower eyelid, the skin of the lateral brow, and the skin of the lower eyelid. This section describes these four approaches. Other periorbital approaches exists and can be useful. Existing lacerations of 2 cm or larger can also be used to approach the orbit.

2 Lower Eyelid Approach

Approaches through the external side of the lower eyelid offer superb exposure to the inferior orbital rim, the floor of the orbit, the lateral orbit, and the inferior portion of the medial orbital rim and wall. These approaches are given many names in the literature, based primarily on the position of the skin incision in the lower eyelid (e.g., blepharoplasty, subciliary, lower lid, subtarsal, infraorbital). Because of the natural skin creases in the lower eyelid and the thinness of eyelid skin, scars become inconspicuous with time. The laxity of skin here also makes the eyelid virtually immune to keloid formation. The infraorbital incision, however, is almost noticeable to some degree.

SURGICAL ANATOMY

Lower Eyelid (1)

In the sagittal section, the lower eyelid consists of at least four distinct layers – the skin and subcutaneous tissue, the orbicularis oculi muscle, the tarsus (upper 4 to 5 mm) or orbital septum, and the conjunctiva (Fig. 2-1).

Skin. The outermost layer is the skin, comprising the epidermis and the very thin dermis. The skin of the eyelids is the thinnest skin in the body, and has many elastic fibers that allow it to be stretched during dissection and retraction. It is loosely attached to the underlying muscle; hence, in contrast to the situation in most areas of the face, relatively large quantities of fluid may accumulate subcutaneously in this loose connective tissue. The skin derives its blood supply from the underlying perforating muscle vessel (see subsequent text).

Muscle. Subjacent and adherent to the skin lies the orbicularis oculi muscle, the sphincter of the eyelids (Fig. 2-2). This muscle completely encircles the palpebral fissure and extends over the skeleton of the orbit. In can thus be divided into orbital and palpebral portions (Fig. 2-3). The palpebral portion can be further subdivided into the pretarsal portion (the muscle superficial to the tarsal plates) and the preseptal portion (the muscle superficial to the orbital septum). The palpebral portions of the orbicularis oculi muscle are very thin ion cross section, especially at the junction of the pretarsal and preseptal portion. The orbital portion of the orbicularis oculi muscle takes its origin medially from the bones of the medial orbital rim and the medial canthal tendon. The peripheral fibers sweep across the eyelid over the orbital margin in a series of concentric loops, the more central ones forming almost complete rings. In the lower eyelid, the orbital portion extends below the inferior orbital rim onto the cheek, and covers the origins of the elevator muscle of the upper lip and nasal ala. The orbital portion of the orbicuralis oculi muscle is responsible for the tight closure of the eye.

The preseptal portion of the orbicularis oculi muscle originates from the medial canthal tendon and lacrimal diaphragm and passes across the lid as a series of half-ellipses, meeting at the lateral canthal tendon. The upper and lower pretarsal muscles contribute to a common lateral canthal tendon about 7 mm from the lateral orbital tubercle, where it inserts. Medially, they unite to form the medial canthal tendon, which inserts on the medial orbital margin, the anterior crest, and nasal bones. The palpebral portions of the orbicularis oculi muscle function to close the eye without effort, as in blinking. It also functions to maintain contact between the lower lid and the ocular globe.

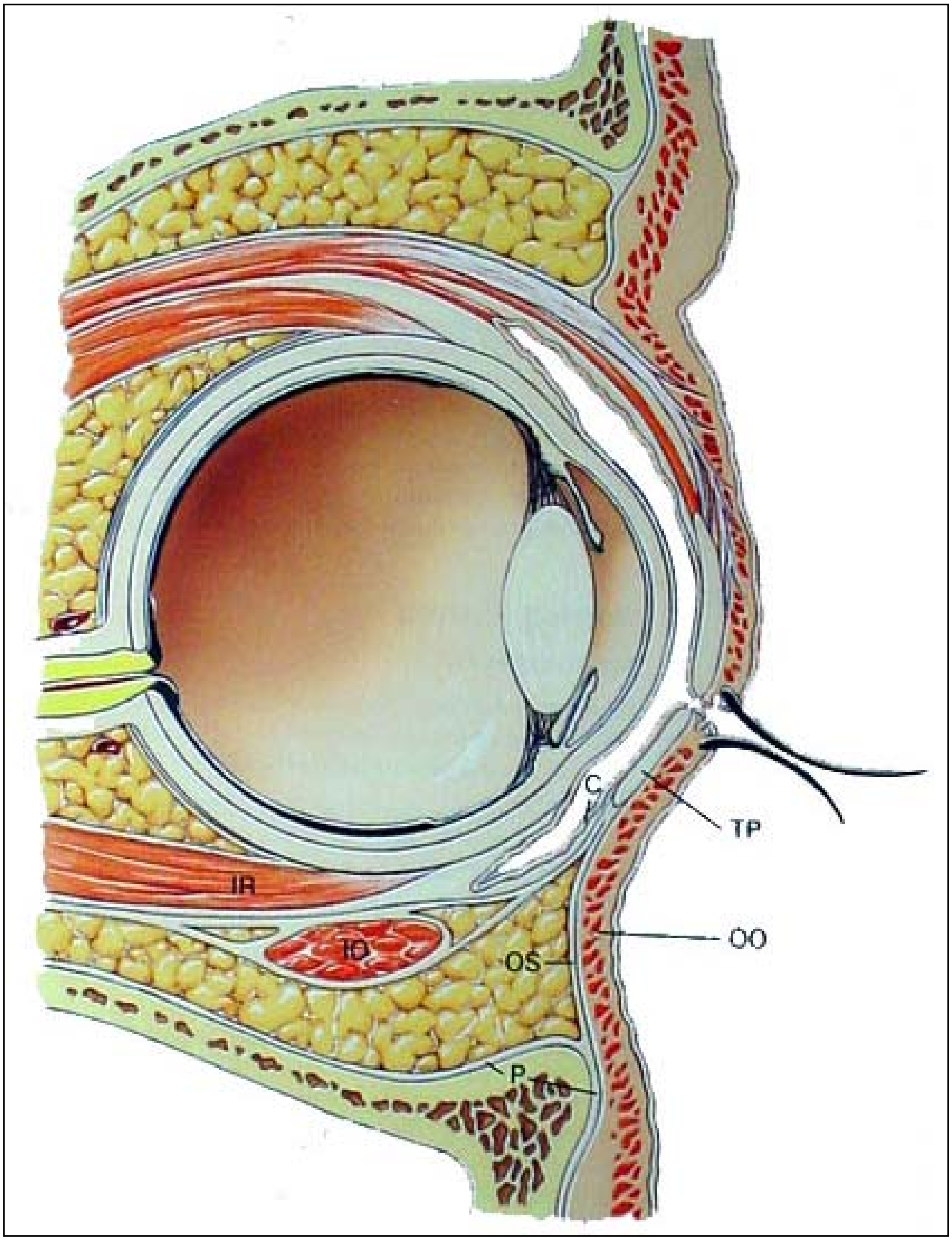


Figure 2- 1 Sagital section through orbit and globe. C=palpebral conjuntiva; IO=inferior oblique muscle; IR=inferior rectus muscle; OO=orbicularis oculi muscle; OS=orbital septum;P=periosteum/periorbita; TP=tarsal plate.

Figure 2- 2 Anatomic dissection of orbicularis oculi muscle fibers. Note the extreme thinness in this older specimen

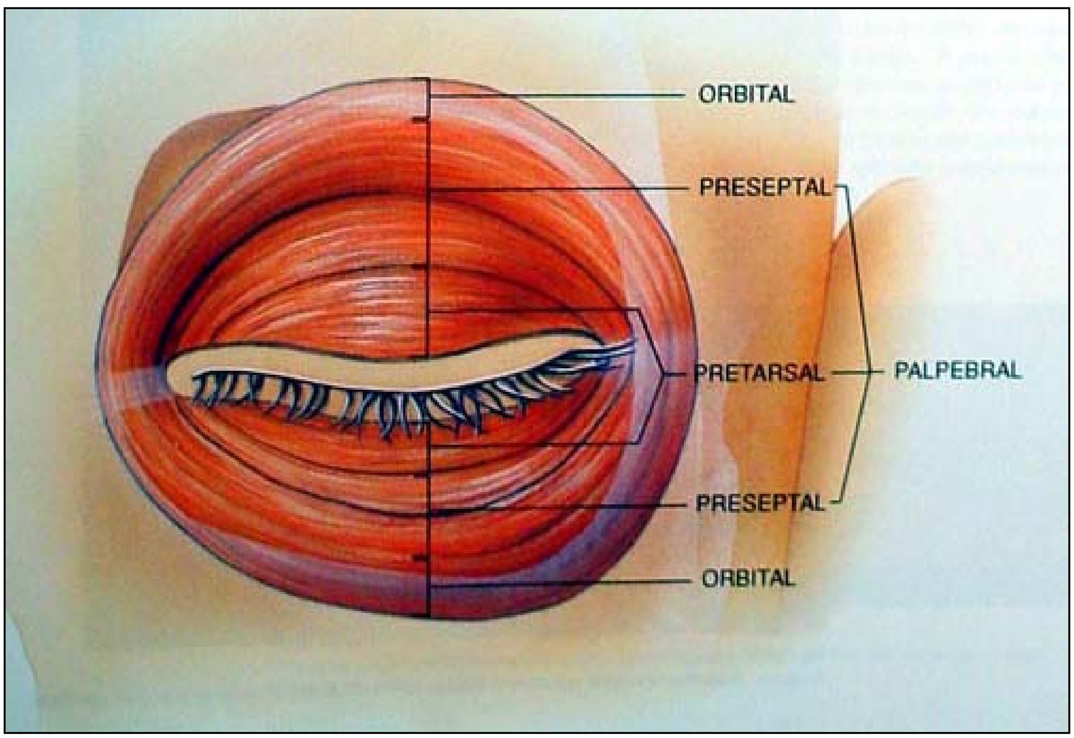


Figure 2- 3 Orbital and palpebral portions of orbicularis oculi muscle. The palpebral portion is divided into the fibers in front of the tarsus (pretarsal portion) and those in front of the orbital septum (preseptal portion).

The orbicularis oculi muscle receives innervation from the lateral side, from branches of the facial nerve that enter the muscle on its deep surface. The blood supply to the orbicularis oculi muscle is from the external facial artery tributaries that come from deep branches of the ophthalmic artery. These arterial branches form a marginal arcade, traversing between the tarsal plate and muscle and giving rise to branches perforating the substance of the muscle, orbital septum, and tarsal plate.

Orbital Septum/Tarsus. The orbital septum is a fascial structure that forms a diaphragm between the contents of the orbit and the superficial face (Figs. 2-1 and 2-4). It is usually more dense laterally than medially, but varies considerably in thickness from one individual to another. The orbital septum is a fascial extension of the periosteum of the bones of the face and orbit. It takes its origin along the orbital rim for most of its extent. Laterally and inferolaterally, however, it arises from the periosteum 1 to 2 mm beyond the rim of the orbit. Thus, it is necessary to dissect a few mm lateral and/or inferior to the orbital rim before incising the periosteum to prevent incising through the orbital septum.

The orbital septum in the lower eyelid inserts onto the inferior margin of the lower tarsus. The *tarsal plate* of the lower eyelid is a somewhat thin, pliable fibrocartilaginous structure that gives form and support to the lower eyelid (Figs. 2-5 and 2-6). The edge of the tarsus adjacent to the free border of the lid parallels the palpebral fissure, while the deeper (inferior) border is curved so that the tarsus is somewhat semilunar in shape. It is also, of course, curved to conform to the outer

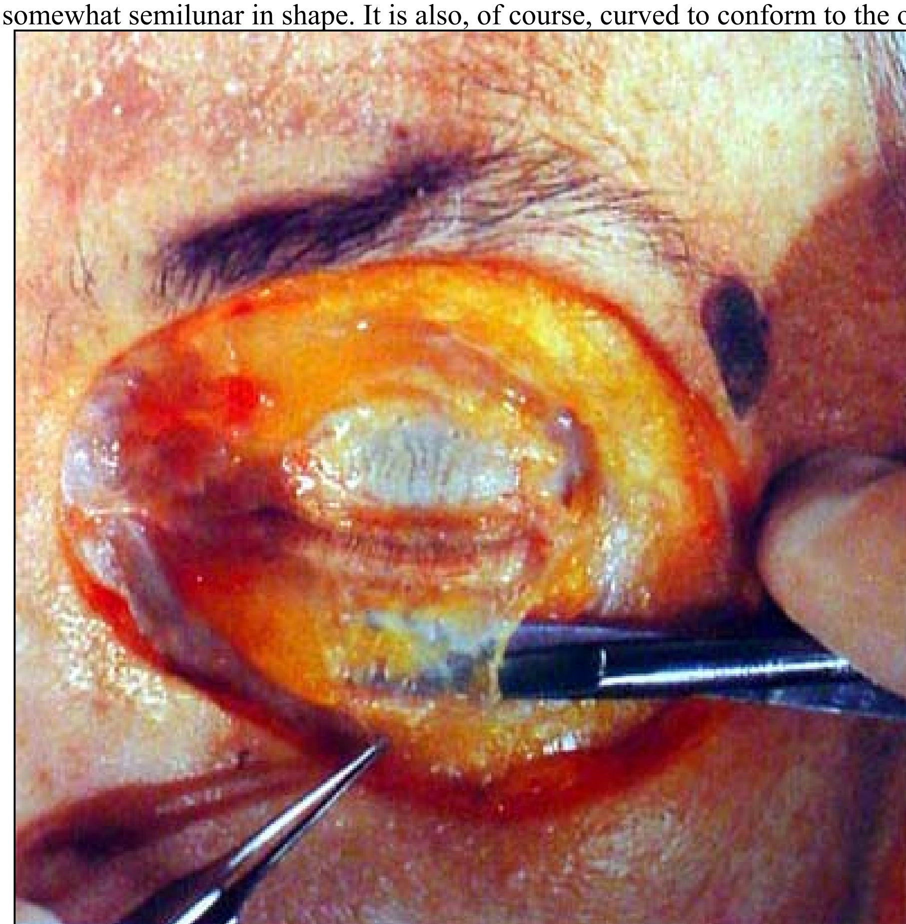


Figure 2- 4 Anatomic dissection of orbital septum in the lower eyelid. Note the thinness in this older specimen.

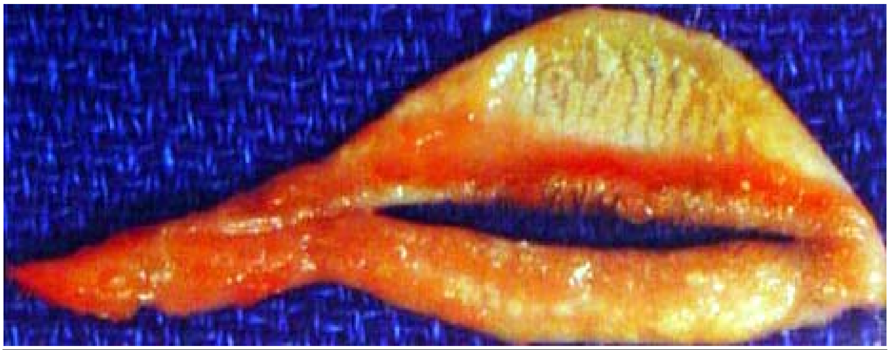


Figure 2- 5 Anterior surface of tarsal plates and canthal tendons (left eye). Note the difference in size between the upper and lower tarsal plates.

surface of the eyeball. The inferior tarsus is considerably smaller than the superior one, the greatest height of the inferior being about 4 to 5 mm and that of the superior about 10 mm. The tarsal glands sandwiched between the layer of fibrocartilage in the lower eyelid are smaller than their upper eyelid counterpart, and exit on the lid margin near the lash follicles. The lashes are supported by their roots, attached to fibrous tissue on the tarsal plate, not in the orbicularis oculi muscle anterior to the tarsal plate. Laterally, the tarsal plate becomes a fibrous band that adjoins the structural counterpart from the upper lid, forming the lateral canthal tendon. Medially, the tarsal plate also becomes fibrous and shelters the inferior lacrimal canaliculus behind as it becomes the medial canthal tendon.

Embedded within the tarsal plates are large sebaceous glands called the tarsal or Meibomian glands, whose ducts may be seen along the lid margin. A grayish line or a slight groove sometimes visible between the lashes and the openings of the tarsal glands represents the junction of the two fundamental portions of the eyelid, the skin and muscle on one hand and the tarsus (the plate of closely packed tarsal glands) and conjunctiva on the other. This indicates a plane along which the lid may be split into anterior and posterior portion with minimal scarring.

Figure 2- 6 Posterior surface of the tarsal plates and canthal tendons (left eye). Note the vertically arranged Meibomian glands, visible through the thin

Palpebral Conjunctiva. The conjunctiva that lines the inner surface of the eyelids is called the palpebral conjunctiva (see Fig. 2-1). It adheres firmly to the tarsal plate, and as it extends inferiorly toward the inferior conjunctival fornix, it becomes more loosely bound. At the inferior conjunctival fornix, the conjunctiva sweeps onto the ocular globe to become the bulbar conjunctiva.

Lateral Canthal Tendon

The lateral canthal tendon, ligament, or raphé as it is frequently called, is a fibrous extension of the tarsal plates laterally toward the orbital rim (fig. 2-7). As will be seen in the medial canthal tendon, the lateral tendon has a superficial and deep component. The base of the ligamentous complex is shaped like a Y and is attached to the external angle of the two tarsi (Fig. 2-8). The two divisions diverge from the tarsi and the superficial component extends laterally just under, or intermingling with the orbicularis oculi muscle. It continues lateral to the orbital rim and inserts into the periosteum overlying the lateral orbital rim and the temporalis fascia just lateral to the orbital rim. The thicker, stronger deep component of the lateral canthal tendon courses posterolaterally, inserting into the periosteum of the orbital tubercle of the zygoma, approximately 2 to 3 mm posterior to the orbital rim. The space between the two bundles of the lateral canthal tendon is filled with loose connective tissue.

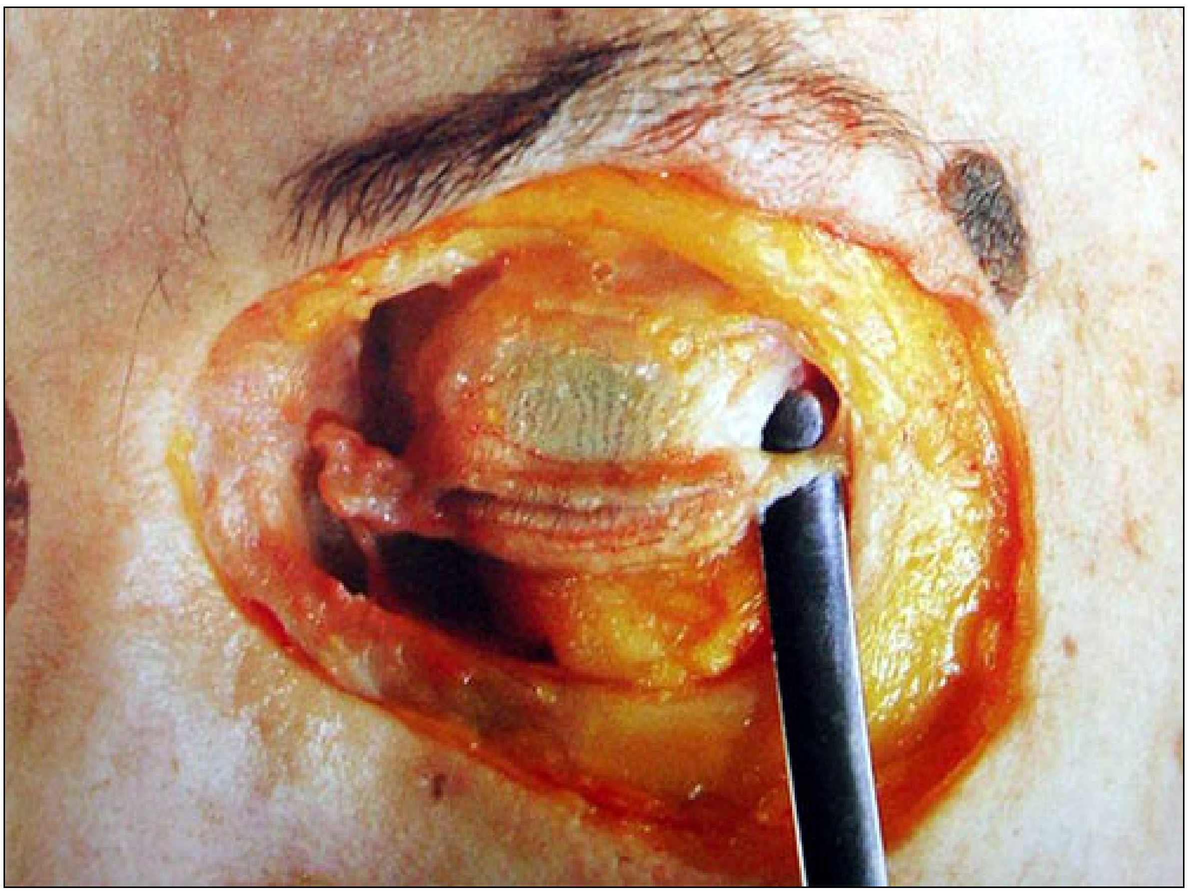


Figure 2- 7 Anatomic dissection of the deep portion of the lateral canthal tendon. Note that it attaches posterior to the orbital rim.

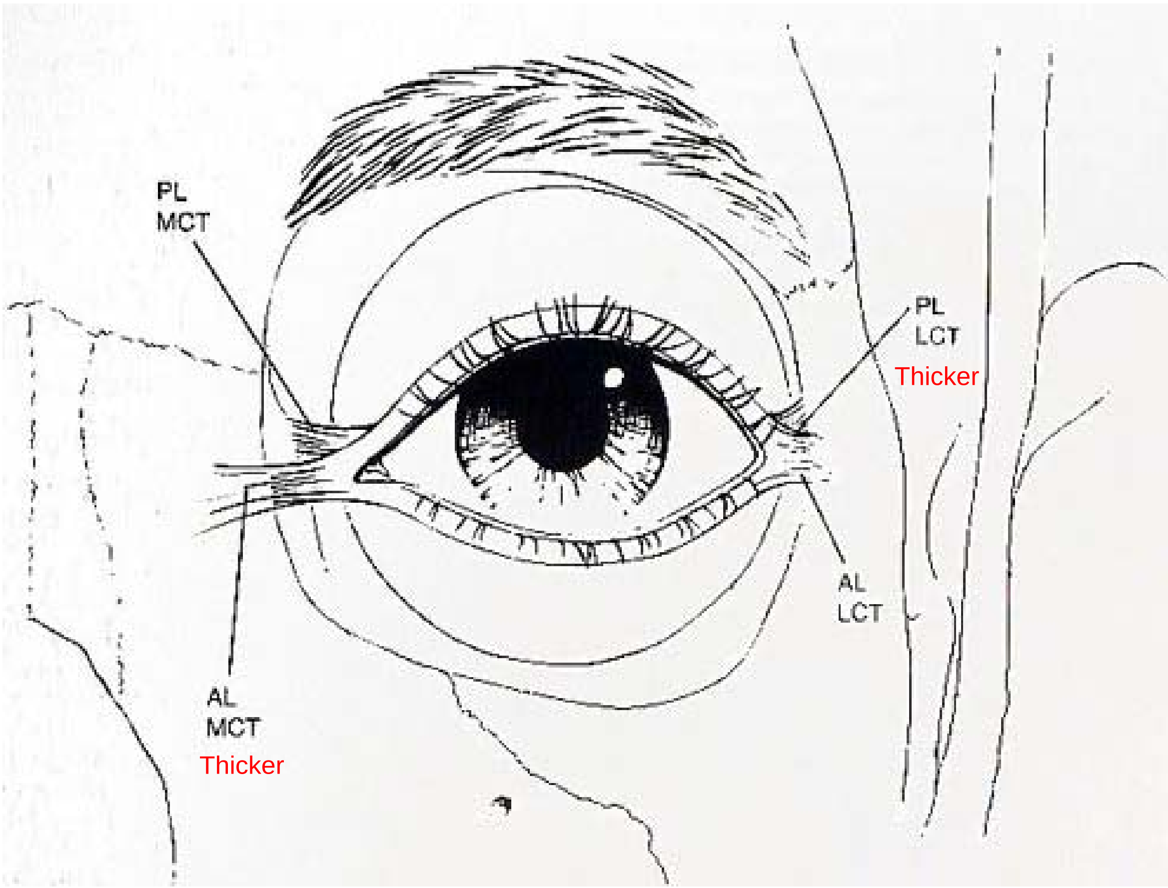


Figure 2- 8 Medial and lateral canthal tendon complexes. Note that the anterior limb of the medial canthal tendon (AL, MCT) and the posterior limb of the lateral canthal tendon (PL LCT) are thicker. The thicker anterior portion of the medial canthal tendon attaches to the anterior lacrimal crest of the maxilla and the frontal process of the maxilla. The thinner posterior limb of the medial canthal tendon (PL MCT) attaches along the posterior lacrimal crest of the lacrimal bone. The thick posterior portion of the lateral canthal tendon (PL LCT) attaches to the orbital (Whitnall's) tubercle of the zygoma, 3 to 4 mm posterior to the lateral orbital rim. The thinner anterior fibers course laterally to mingle with the orbicularis oculi muscle fibers and the periosteum of the lateral orbital rim.

Medial Canthal Tendon

The medial canthal tendon attaches to the medial bony orbit by superficial and deep components that attach to the anterior and posterior lacrimal crests (Fig 2-8 and 2-9) (2,3). The medial canthal tendon originates at the nasal border of the upper and lower tarsi, where the preseptal muscle divide into superficial and deeps heads (4). The lacrimal puncta are located here. Thus, the lacrimal canaliculi of the upper and lower lid margins extend from the medial border of the tarsi toward and behind the medial canthus. Continuing medially, the tendon fans out to insert into the anterior lacrimal crest and beyond onto the frontal process of the maxilla. The anterior lacrimal crest, which is 2 to 3 mm medial to the canthal apex, protects the lacrimal sac. Thus, an incision farther medial than 3 mm from the canthus misses both the canaliculi and the sac.

The anterior horizontal segment is the strongest component of the medial canthal tendon complex and is attached most firmly at the anterior lacrimal crest. The thinner posterior limb inserts on the posterior lacrimal crest and functions to maintain the eyelids in a posture tangent to the globe. The resultant vectors of all of the canthal attachments suggests that resuspension of the entire complex following disruption should be posterior and superior to the anterior lacrimal crest.

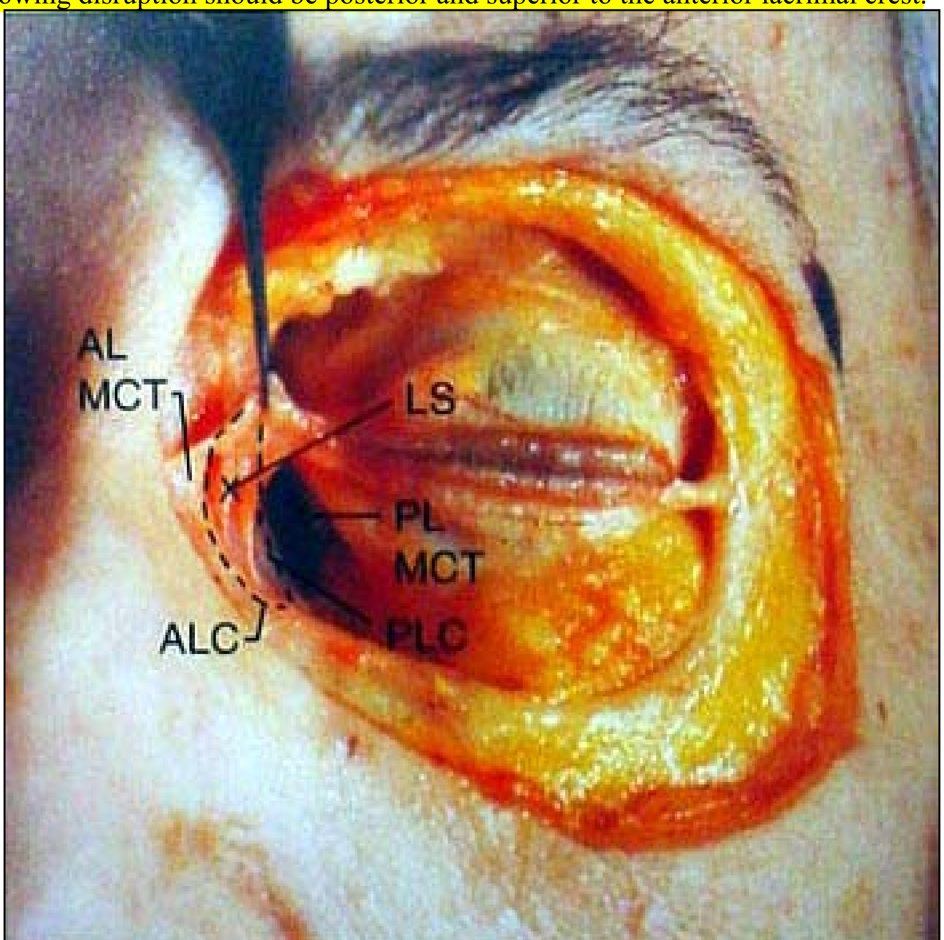


Figure 2-9 Anatomic specimen showing the anterior and posterior components of the medial canthal tendon complex. AL MCT=anterior limb; ALC=anterior lacrimal crest; LS=lacrimal sac; PL MCT=posterior lomb; PLC=posterior lacrimal crest.

Infraorbital Groove

The infraorbital neurovascular bundle enters the posterior orbit through the inferior orbital fissure and runs almost straight anteriorly in the infraorbital groove of the orbital floor (Fig. 2-10). More anteriorly, the infraorbital groove is usually roofed over with a thin layer of bone, forming the infraorbital canal, which leads the neurovascular bundle through the infraorbital foramen to the superficial structures of the face.

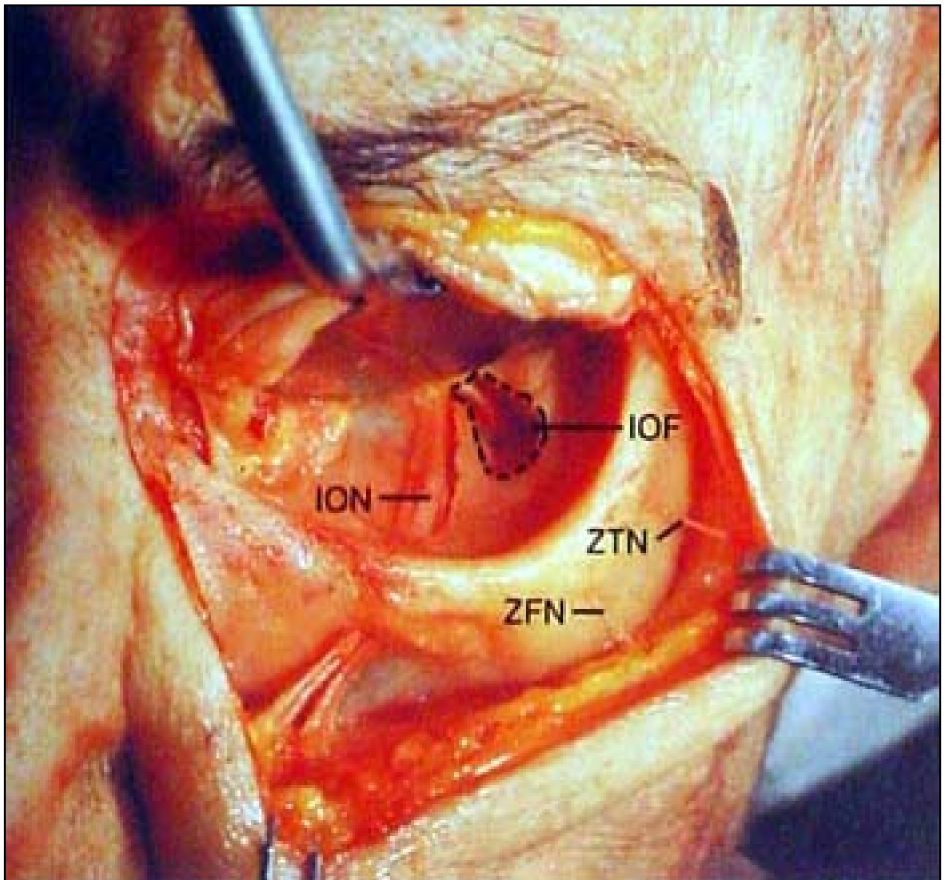


Figure 2 10 Anatomic dissection **of** the orbital floor, lateral and inferior orbital rims. IOF=Inferior orbital fissure anfter incision of contents; ION-Infraorbital nerve in canal/groove after unroofing; ZFN=zygomaticofacial nerve; ZTN=zygomaticotemporal nerve.

TECHNIQUE

Several external incisions of the lower eyelid to gain access to the infraorbital rim and orbital floor have been described. The major difference between them is the level at which the incision is placed in the skin of the eyelid and the level at which the muscle is thansected to expose the orbital septum/periosteum. Each incision has advantages and disadvantages. The approach shown here, however, is a standard approach that encompasses all of the techniques used in the others. It is most commonly called subciliary incision, but is also known as infraciliary or blefharoplasty incision. This incision is merely a lower lid incision at a higher level that in the lower lid incision, made just below the eyelashes. The main advantage of this incision is the imperceptible scar that it creates. Further, it can be extended laterally for additional exposure of the entire lateral orbital rim.

Once the skin is incised, the surgeon has three options. The first is to dissect between the skin and the muscle until the orbital rim is reached, at which point another incision through muscle and periosteum is made to the bone. The second option is to incise through muscle at the same level as the skin incision and dissect down just anterior to the orbital septum to the orbital rim. The third option is a combination of these in which subcutaneous dissection toward the rim proceeds for a few millimeters followed by incision through the muscle at a lower level, producing a step-incision, then following the orbital septum to the rim.

Although all three options are advocated by several surgeons, each has advantages and disadvantages. The first option, in which a subcutaneous dissection to the level of the infraorbital rim is made, leaves an extremely thin skin flap. This flap is technically difficult to elevate, and accidental "buttonhole" dehiscence can occur. A further problem that may occasionally be seen is a slight darkening of the skin in this area after healing. Presumably, the skin flap becomes avascular and essentially acts as a skin graft. An increase in the incidence of ectropion has also been noted by some investigators with this approach. Entropion and lash problems have occasionally been experienced after this "skin only" flap.

The second option, in which the dissection is made between muscle and orbital septum, is technically less difficult. Care must be taken, however, because the thin orbital septum can be easily violated, causing periorbital fat to herniate into the wound. In practice, this is more a nuisance than a problem. The skin and muscle flap, however, presumably maintains a better blood supply to the skin, and pigmentation of the lower lid has not been seen.

The third technique, in which a layered dissection is used, avoids the disadvantages of the others. The main advantage of the "stepped" incision through skin and muscle is that the pretarsal fibers of the orbicularis oculi can be kept attached to the tarsal plate, presumably assisting in maintaninig the position of the eyelid and its contact with the globe postoperatively.

Step 1. Protection of the Globe

Protection of the cornea during operative procedures around the orbit may reduce ocular injuries. If one is operating on the skin side of the eyelids to approach the orbital rim and/or orbital floor, a temporary tarsorrhaphy or scleral shell may be useful. These are simply removed at the completion of the operation (Figs. 2-11 and 2-12).

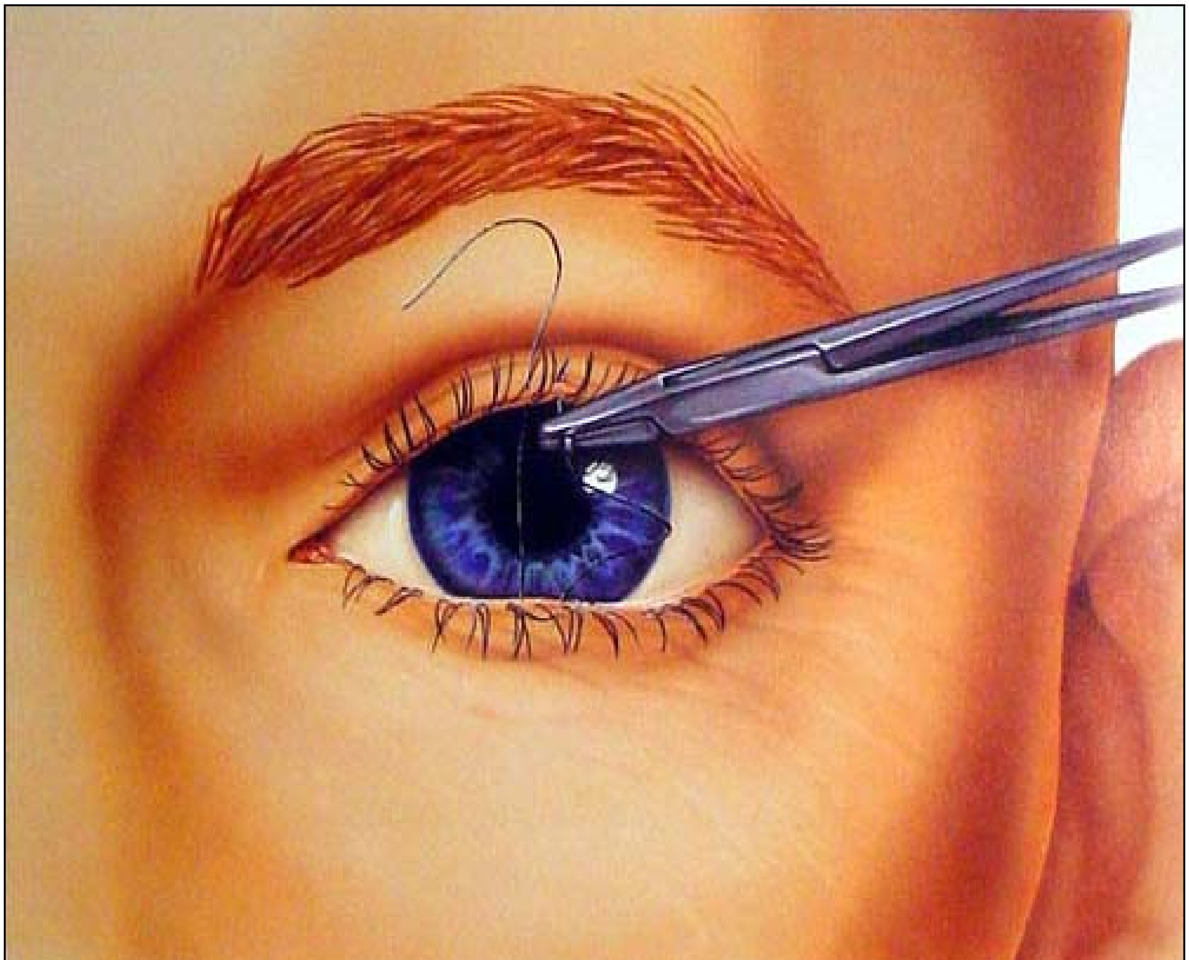


Figure 2-11 Placement of tarsorrhaphy suture.

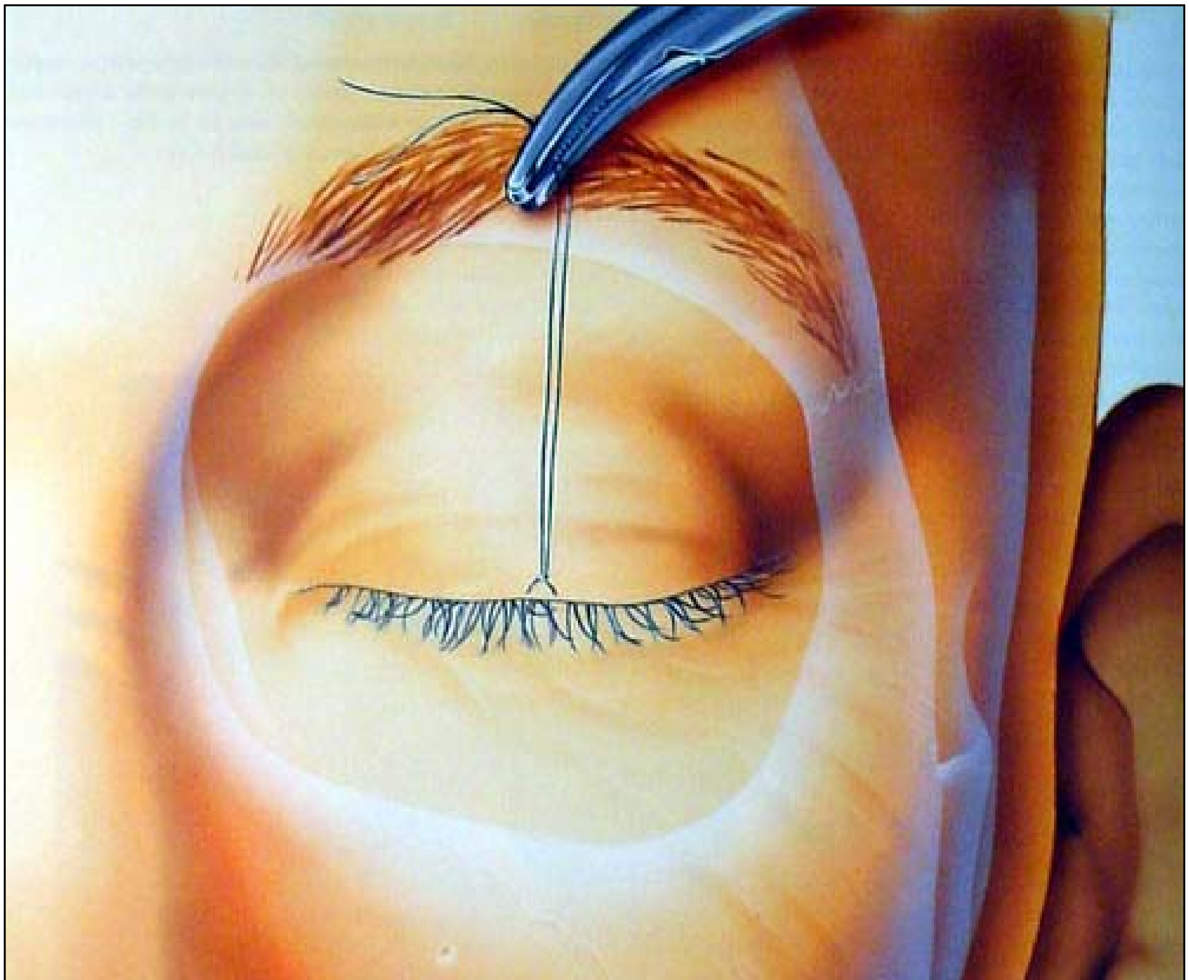


Figure 2-12 tarsorrhaphy suture placed. The suture is left long to be used as a traction suture for dissection.

Step 2. Identification of and Marking Incision Line

One should carefully evaluate the skin creases around the orbit. If the tissues are edematous, the skin surrounding the opposite orbit can be used to obtain an appreciation for the direction of creases. If one chooses to use a crease at the midlevel of the lower eyelid, he should note carefully the direction of the skin crease. Commonly, the crease tails off inferiorly as it extends laterally (Fig. 2-13). If access to the orbital floor and inferior orbital rim are all that is necessary, this "lower lid" incision is satisfactory and will result in an imperceptible scar. This incision, however, should not change direction from the original skin crease or a noticeable scar will result. The tendency is to curve the incision superiorly as it extends laterally. This should be avoided, with the incision placed in the middle of the lower lid unless a natural skin crease does the same.

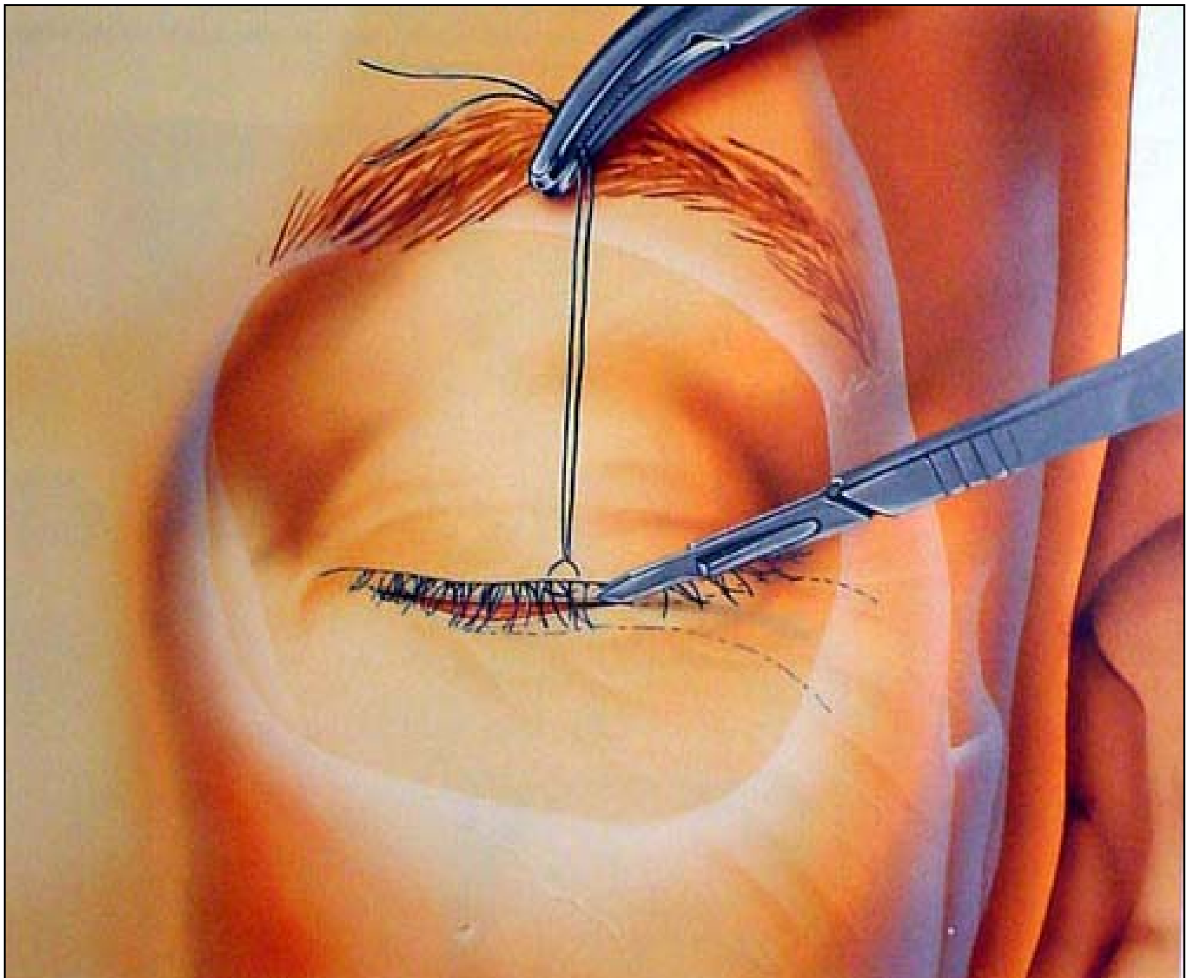


Figure 2-13 Subciliary incision being made. The incision is approximately 2 mm below the eyelashes and can be extended laterally as necessary (top dashed line). It is made throug skin *only*. If one chooses to use a natural skin crease located more inferiorly for incision (lower dashed line), the incision must follow the crease as it tails off inferiorly. One should not use the lower incision and then extend the incision more superiorly as the lateral orbital rim is approached or the relaxed skin tension lines will be crossed,

Step 3. Vasoconstriction

The incision line is marked *before* infiltration of a vasoconstrictor. One must remember that the tissues will distort after infiltration and a perceptible crease may disappear following the injection. Dilute epinephrine solutions before incision are useful for hemostasis and to separate the tissue planes intentionally before incision. This later use, i.e., to "balloon out" the tissue, facilitates incision in the thin lids.

Step 4. Skin Incision

The incision for a subciliary approach is made approximately 2 mm inferior to the lashes, along the entire length of the lid (Fig. 2-13). The incision may be extended laterally approximately 1 to 1,5 cm in a natural crease if more exposure is necessary (see subsequent text). If no natural skin crease extends laterally from the lateral palpebral fissure, the extension can usually be made straight laterally or slightly inferolaterally.

The depth of the inicial incision is through the skin *only*. One should see the underlying muscle when the skin in incised completely (Fig. 2-13).

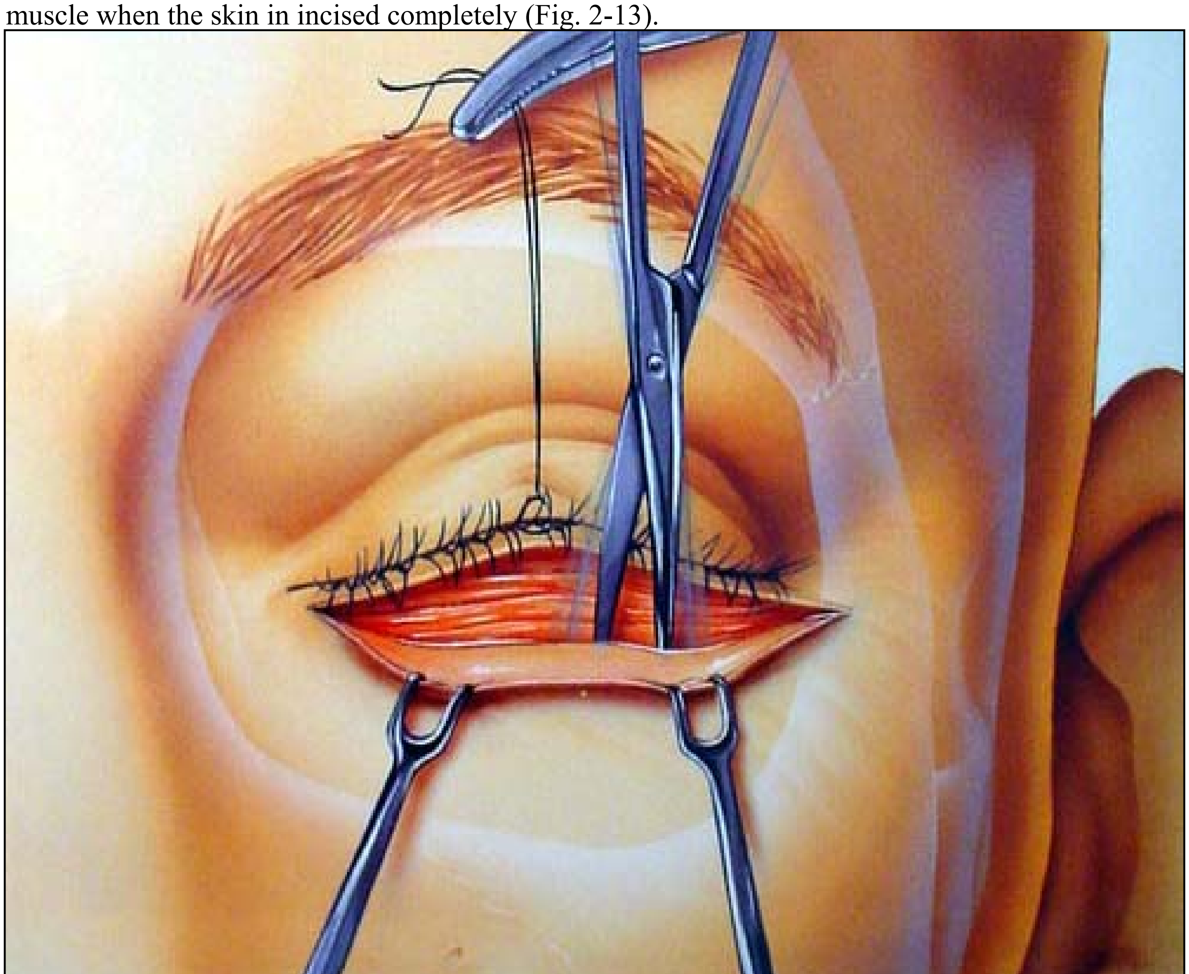


Figure 2-14 Subcutaneous dissection of skin, leaving pretarsal portion of orbicularis muscle attached to the tarsus. Dissection 4 to 6 mm inferiorly in this plane is adequate.

Step 5. Subcutaneous Dissection

Subcutaneous dissection toward the inferior orbital rim proceeds for a few millimeters using sharp dissection with a scalpel or scissors (Fig. 2-14 and 2-15). The tarsorrhaphy suture is used to retract the lower lid superiorly to assist in the dissection. The skin should be separated from the pretarsal portion of the orbicularis oculi muscle along the entire extent of the incision. Approximately 4 to 6 mm of subcutaneous dissection is ample.

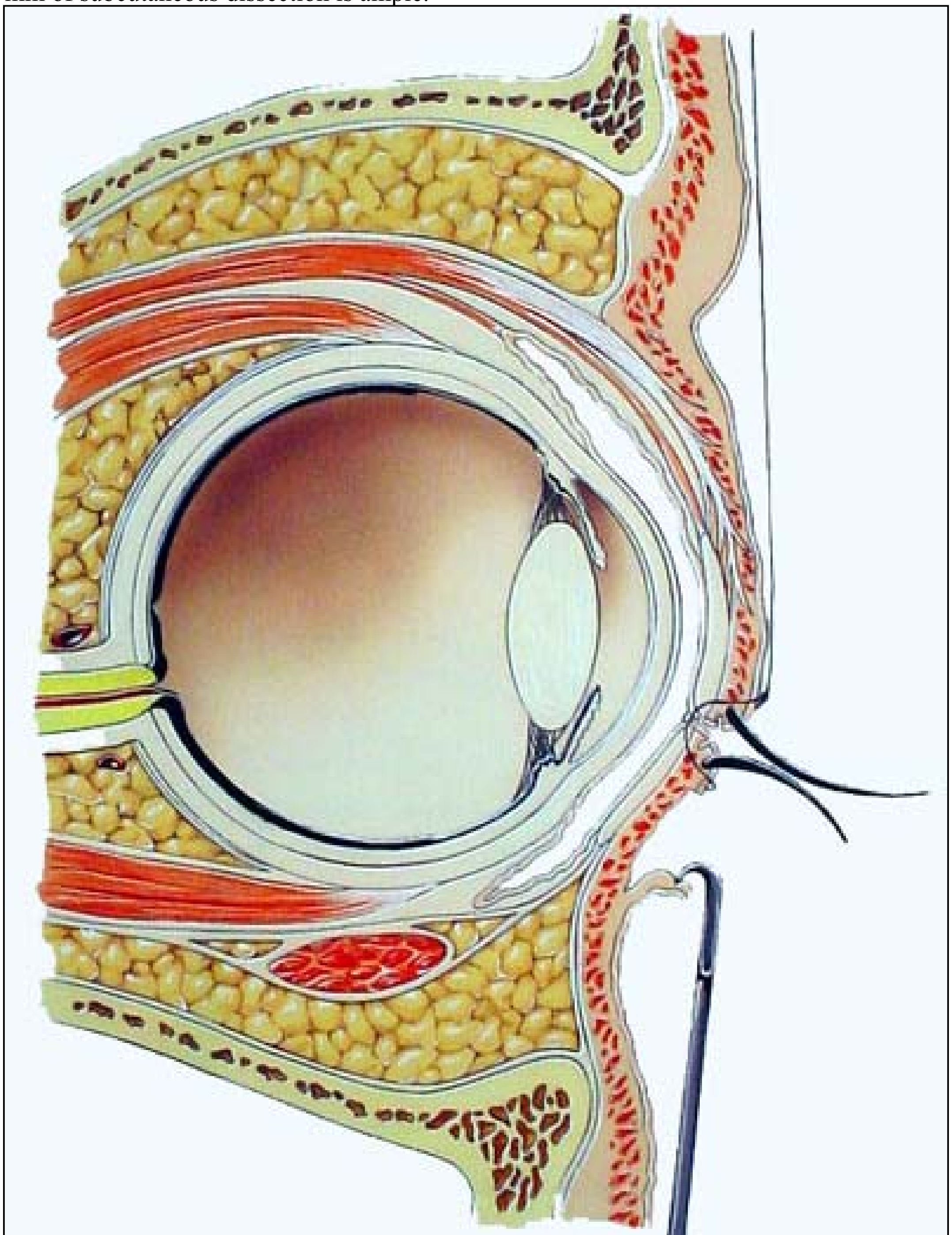


Figure 2-15 Sagital plane through the orbit and globe demonstrating the subcutaneous dissection of the lid margin.

Step 6. Sub-Orbicularis Dissection

Scissors with slightly blunted tips are used to dissect through the orbicularis oculi muscle (by spreading in the direction of the muscle) to the periosteum overlying the lateral orbital rim (Fig. 2-16). The muscle is dissected initially over the bony rim because the depth is much easier to determine here than over the orbital septum. Supraperiosteal dissection continues in this submuscular plane inferiorly along the lateral rim, over the anterior edge of the infraorbital rim, and finally, the scissors are used to spread upward in this pocket into the lower eyelid (Figs. 2-17 and 2-18). The supraperiosteal dissection places the instrument in the proper plane for dissection into the lower eyelid, i.e., between the orbicularis oculi muscle and the orbital septum. The convexity of the curved scissors is outward.

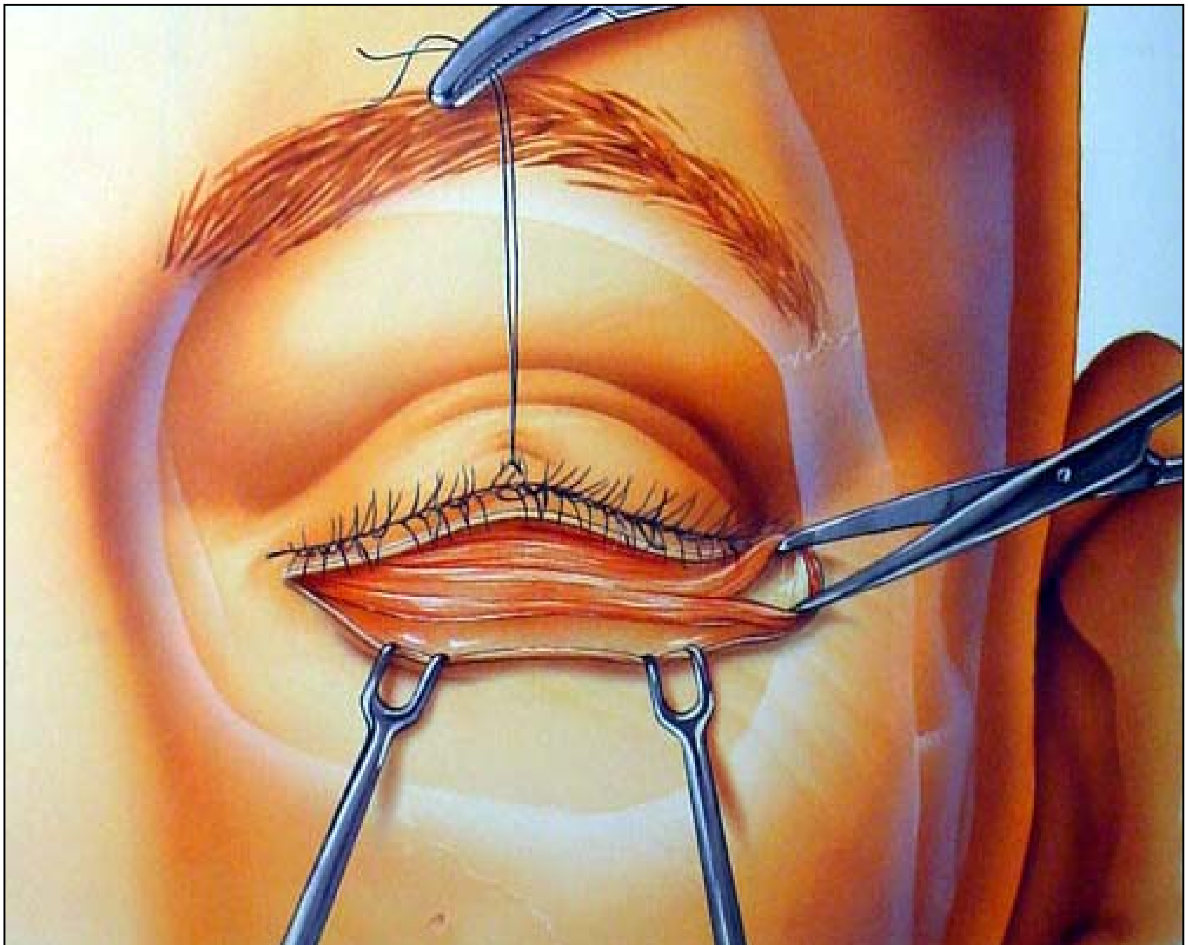


Figure 2-16 Use of scissors to dissect through orbicularis oculi muscle over lateral orbital rim to identify periosteum.

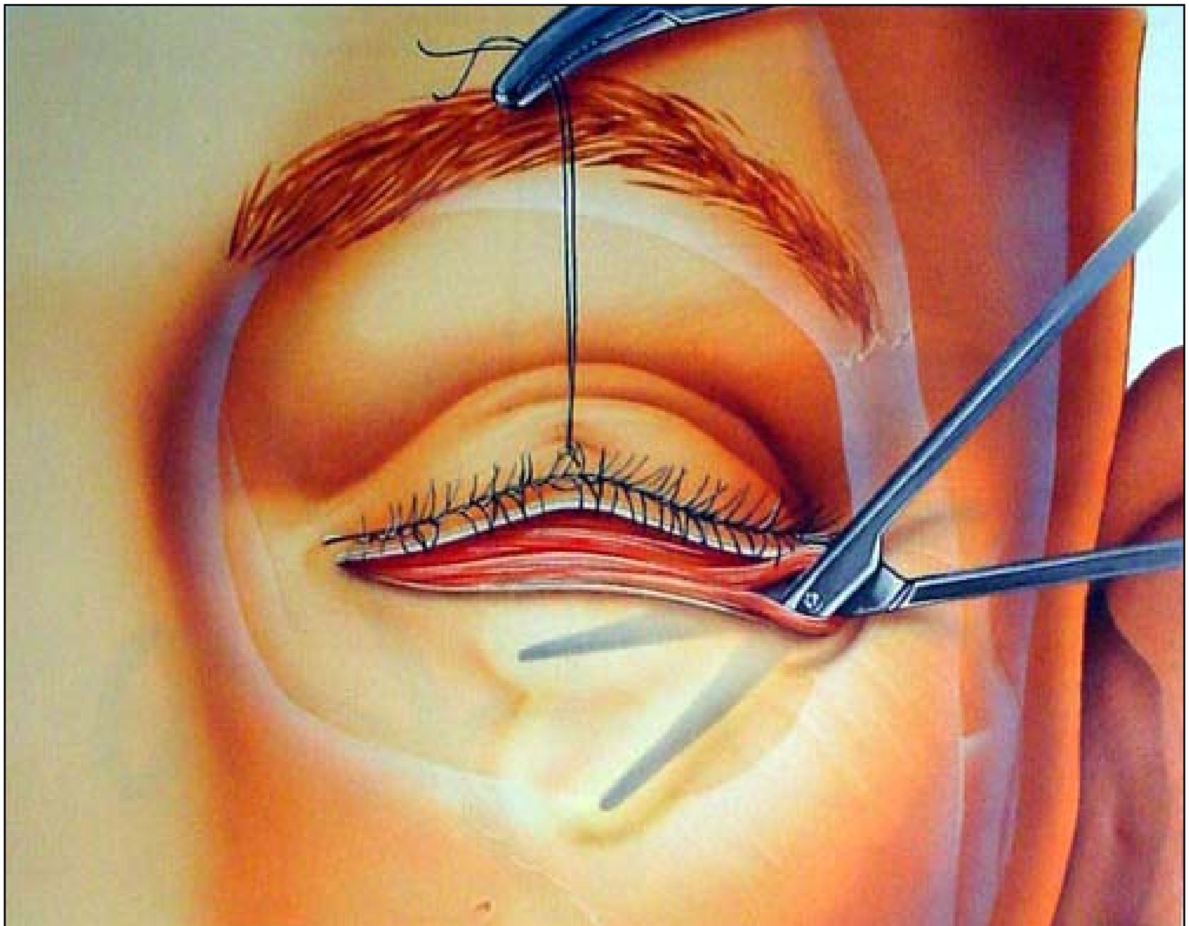


Figure 2-17 Dissection between orbicularis oculi muscle and orbital septum. The dissection should extend completely along the orbital rim and superiorly to the level of subcutaneous dissection.

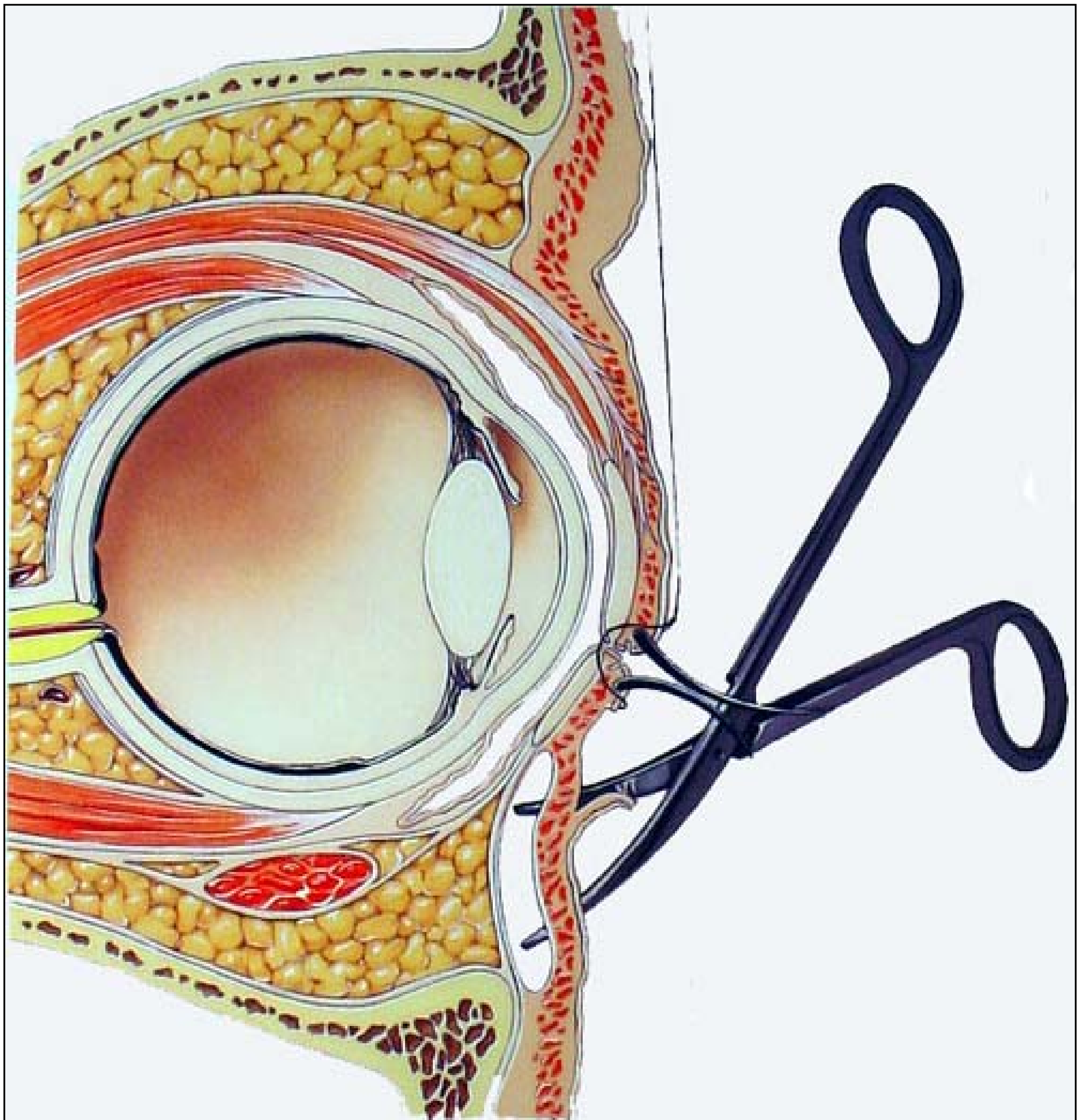


Figure 2-18 Sagital plane through orbit showing level and extent of dissection. Note the bridge of orbicularis oculi muscle remaining between the lid and skin/muscle flap.

Step 7. Incision Between Pretarsal and Preseptal Portions of Orbicularis Oculi Muscle

An attachment of orbicularis oculi muscle will remain, extending from the tarsal plane to the skin muscle flap, which was just elevated from the orbital septum (Fig.2-19). This muscle is now incised with scissors inferior to the level of the initial skin incision (Fig. 2-20).

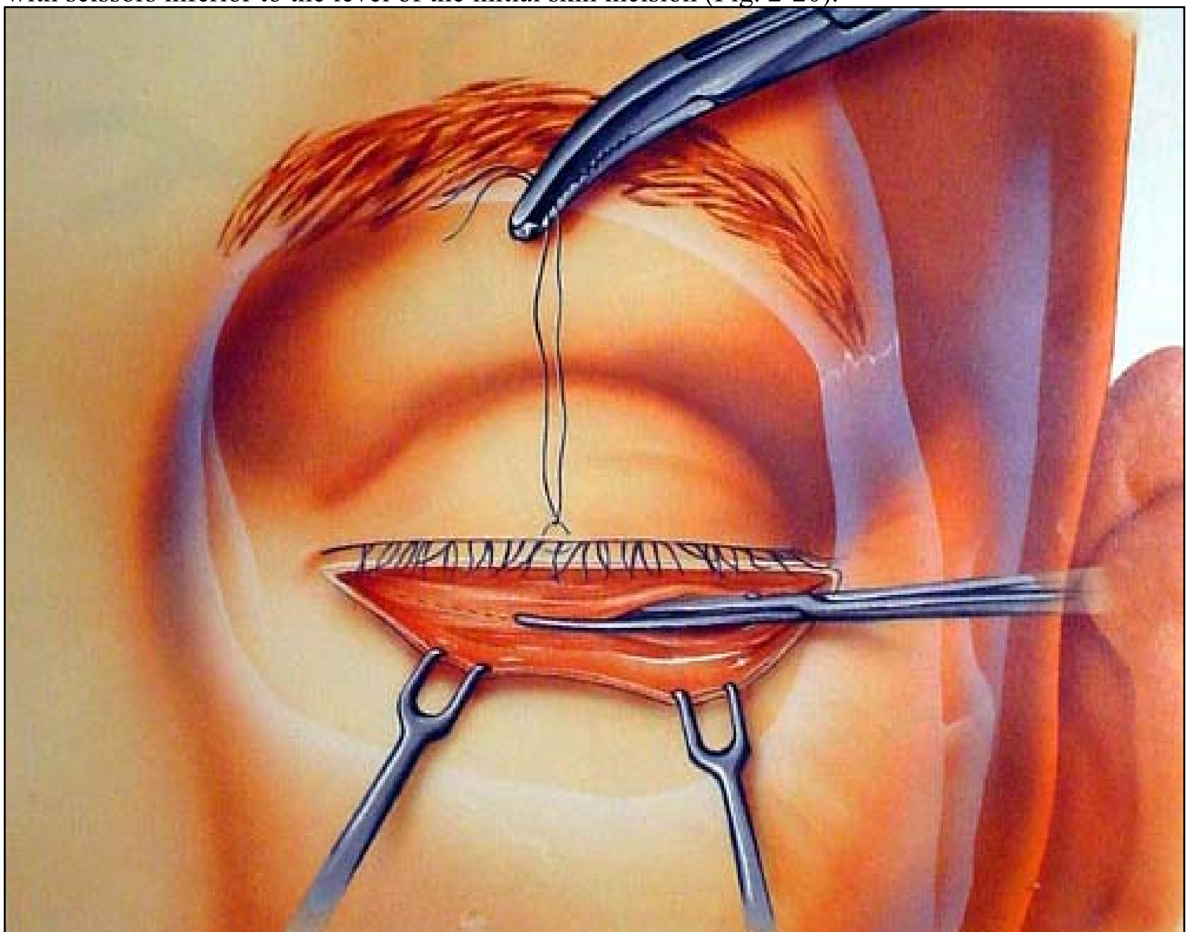


Figure 2-19 Incision through the bridge of orbicularis oculi muscle.

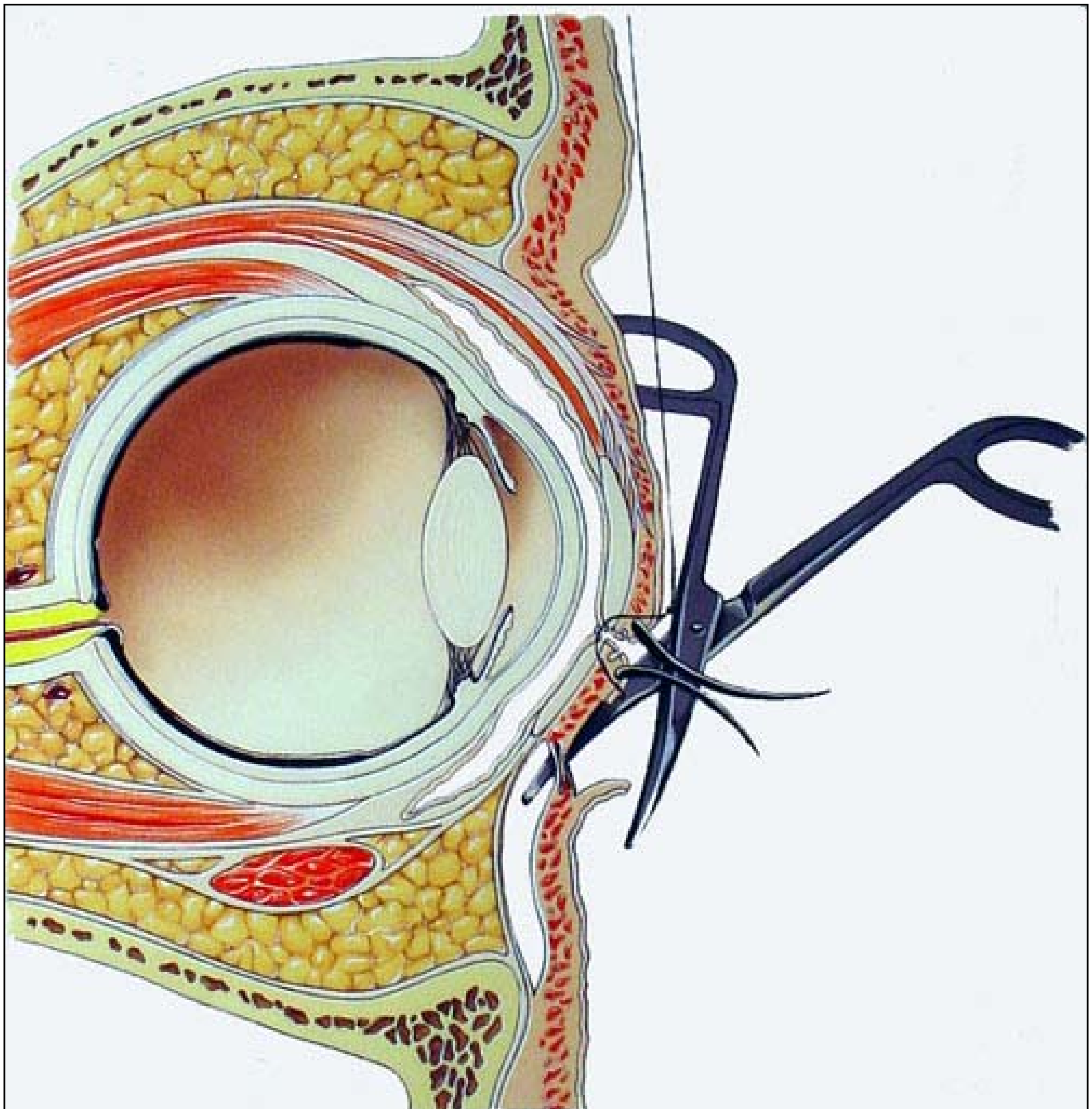


Figure 2-20 Sagital plane through orbit showing incision of the bridge of orbicularis oculi muscle.

Step 8. Periosteal Incision

Once the skin/muscle flap of tissue is elevated from the lower eyelid, it can be retracted inferiorly, extending below the inferior orbital rim. If no violation of the orbital septum occurred, one should see the tarsal plate above with the pretarsal portion of orbicularis oculi still attached, and the orbital septum below extending to the infraorbital rim. An incision through the periosteum on the *anterior* surface of the maxilla and zygoma, 2 to 3 mm below or lateral the orbital rim, can be made with a scalpel (Fig. 2-21). The incision through the periosteum at this level avoids the insertion of the orbital septum along the orbital margin. The infraorbital nerve is approximately 5 to 7 mm inferior to the orbital rim and should be avoided when the periosteal incision is made.

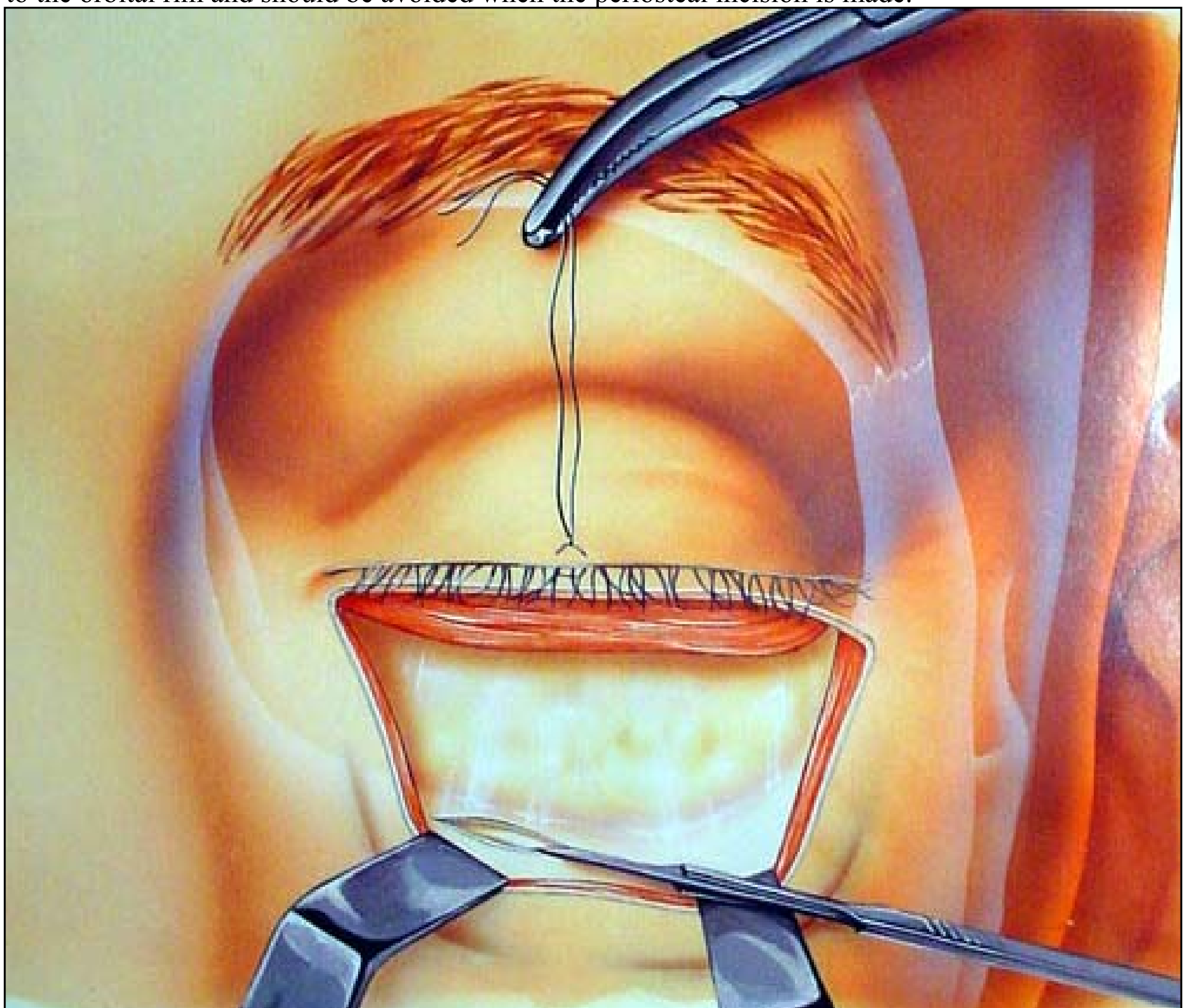


Figure 2-21 Incision through periosteum along anterior maxilla, 3 to 4 mm inferior to infraorbital rim. Note the pretarsal muscle still remaining on the inferior tarsus and the orbital septum, which restricts the orbital fat from entering the field.

Step 9. Subperiosteal Dissection of Anterior Maxilla and/or Orbit

The sharp end of a periosteal elevator is pulled across the full length of the periosteal incision to separate the incised edges. Periosteal elevators are then used to strip the periosteum from the underlying osseous skeleton, both along the anterior surface of the maxilla and zygoma and inside the orbit. The inferior orbital rim is superior to the orbital floor just behind it. After the periosteum of the infraorbital rim is elevated, the elevator is positioned vertically, stripping inferiorly as it proceeds posteriorly for the first centimeter or so (Figs. 2-22 and 2-23). The bony origin of the inferior oblique muscle, the only muscle in the orbit that does not arise from its apex, will be stripped during the subperiosteal dissection. The muscle arises from the floor of the medial orbit

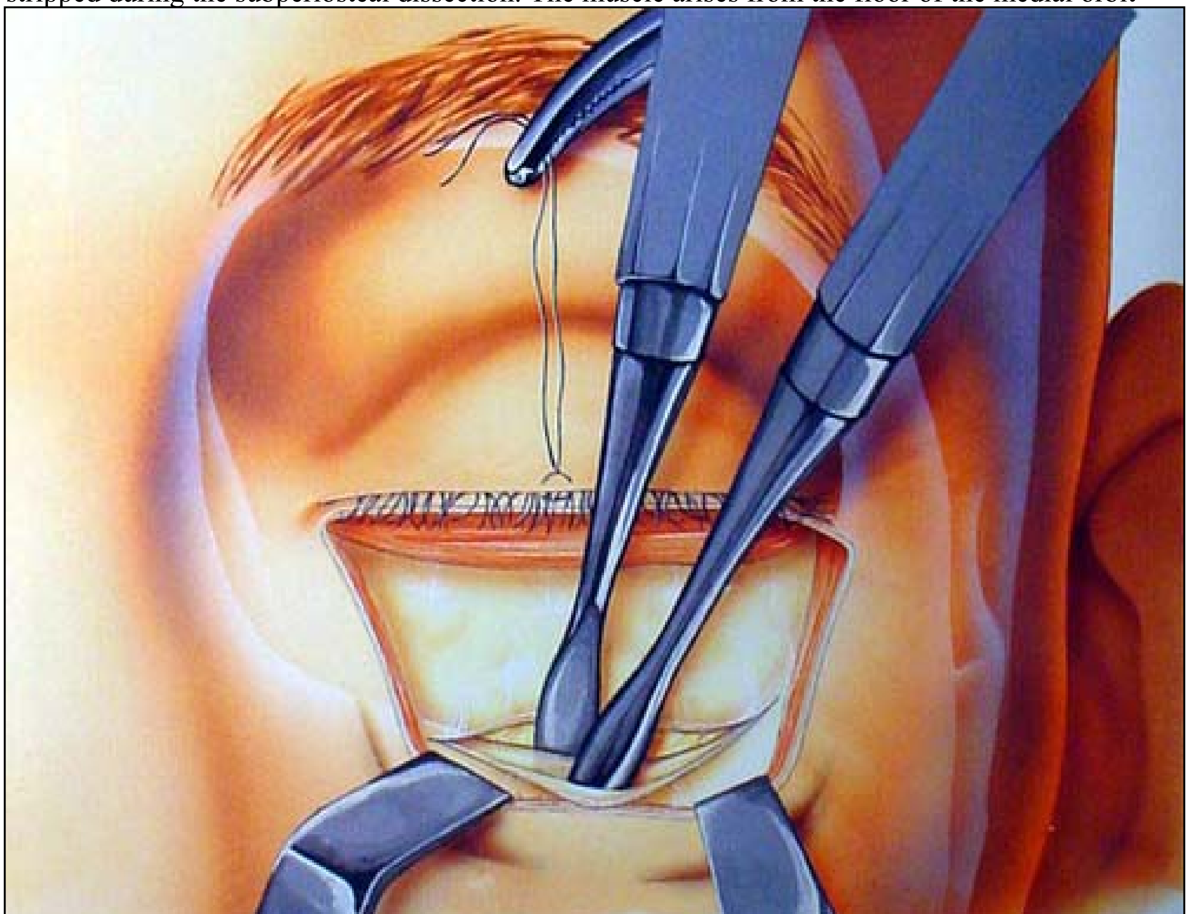


Figure 2-22 Subperiosteal dissection of anterior maxilla and orbital floor. Note that the periosteal elevator entering the orbit is placed almost vertically as dissection proceeds behind the rim. In the anterior region, the floor of the orbit is at a lower level than the crest of the rim, necessitating dissection inferiorly just behind the crest of the rim.

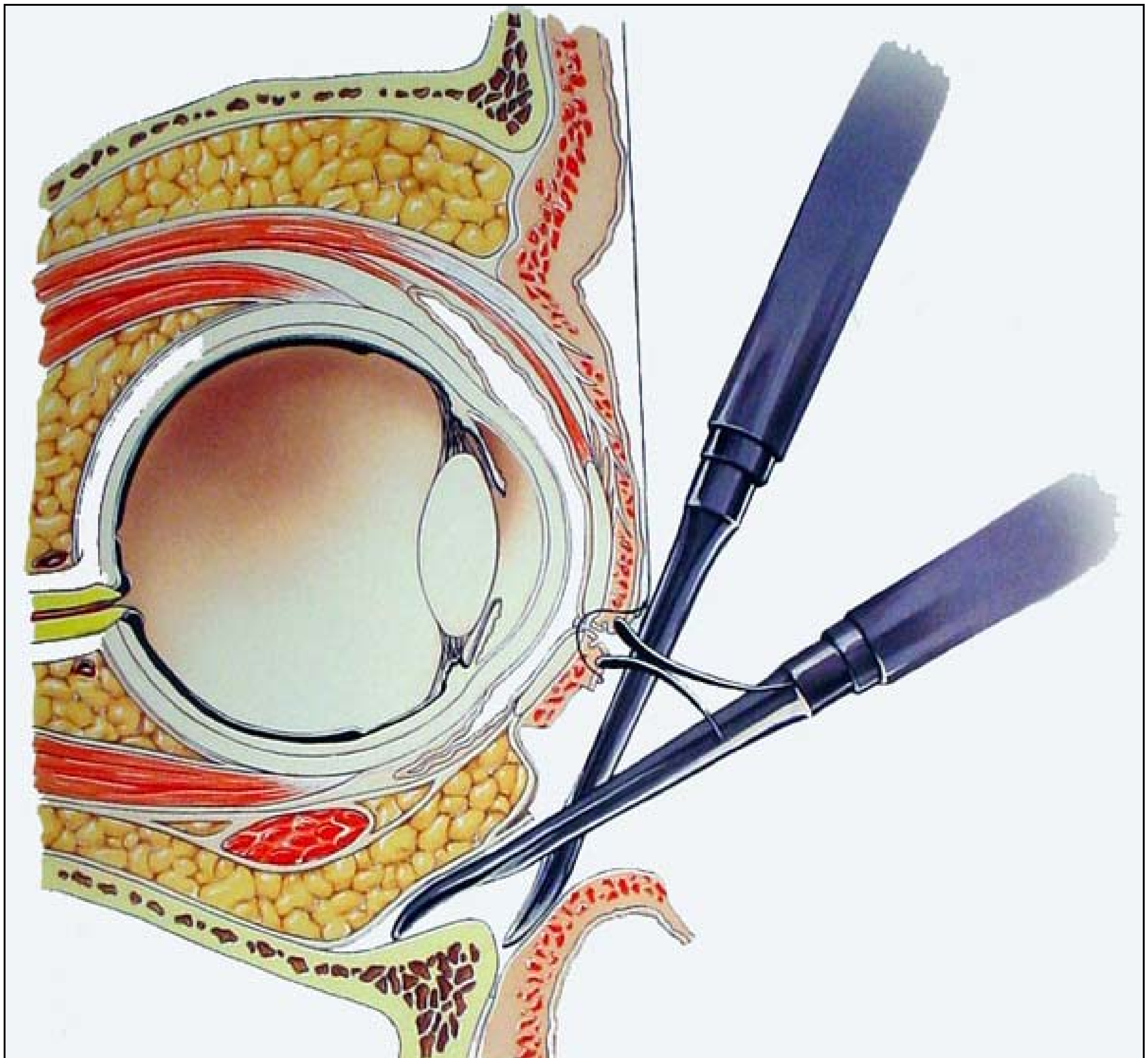


Figure 2-23 Sagital plane through orbit showing subperiosteal dissection of the anterior maxilla and orbital floor.

just posterior to the orbital rim and lateral to the upper aperture of the nasolacrimal canal, and may also arise partly from the lacrimal fascia over the lacrimal sac (Fig. 2-24). During dissection, one will readily encounter the inferior orbital fissure. The periosteum of the orbit (periorbita) sweeps downward into the fissure. If necessary, the contents of the inferior orbital fissure can be incised to provide more exposure (Figs. 2-25 and 2-26).

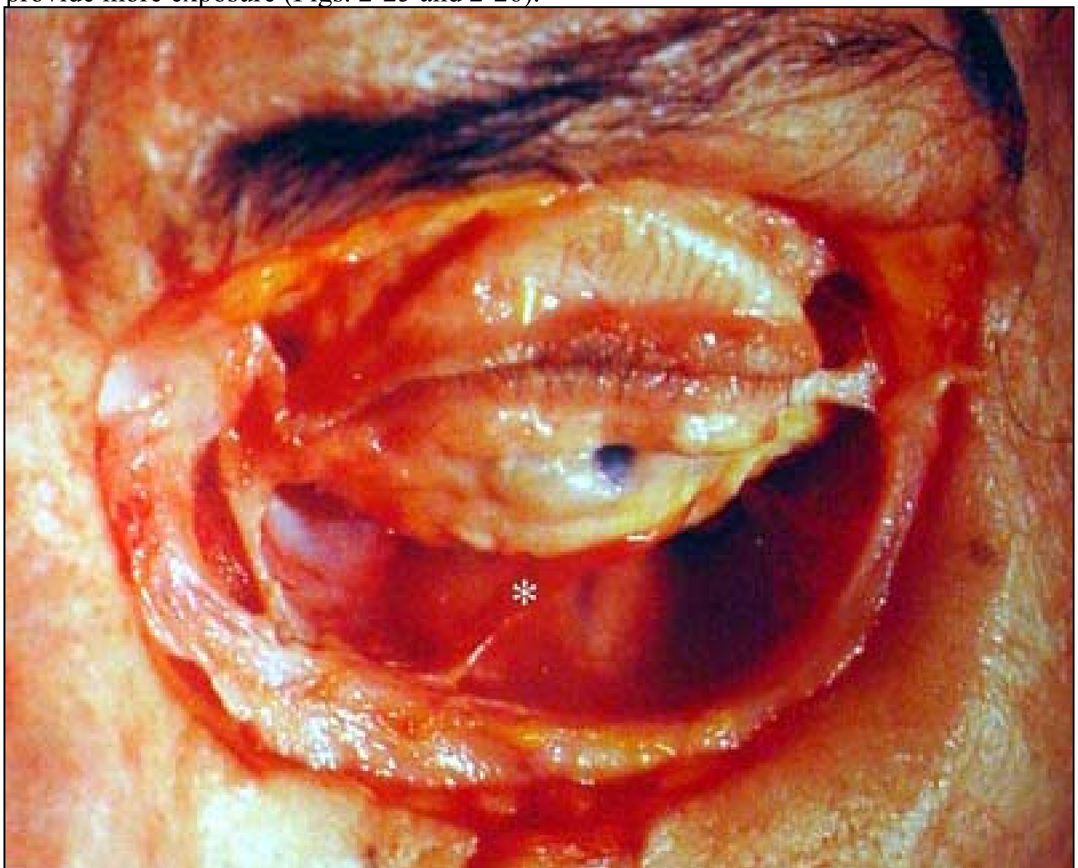


Figure 2-24 Anatomic dissection showing the position of the inferior oblique muscle (*). It should not be directly visualized if one stays in the subperiosteal plane because its origin will be stripped from the orbital floor along with the periosteum.

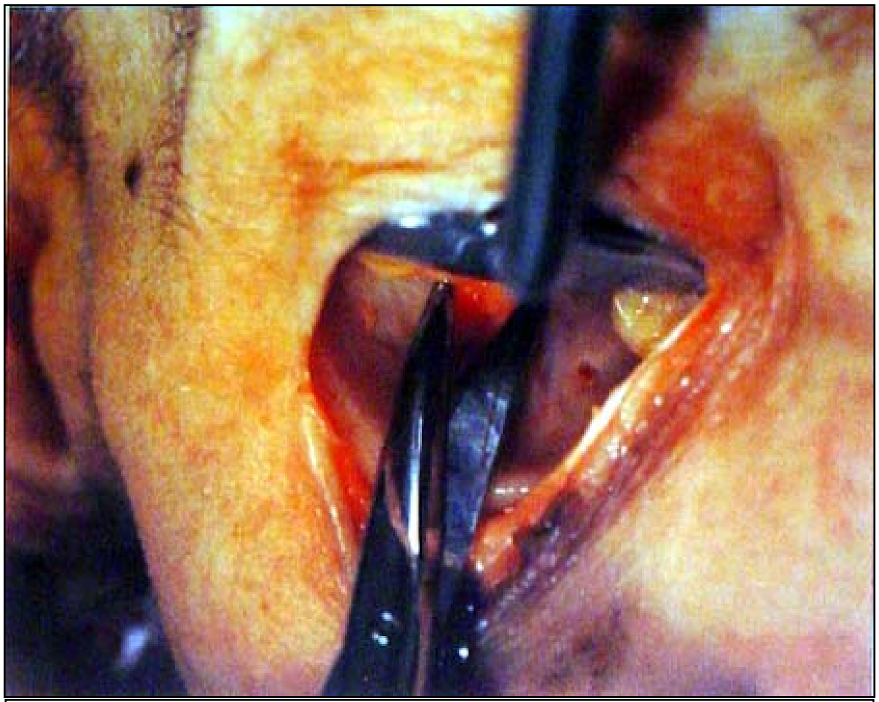


Figure 2-25 Anatomic dissection showing incision through the contents of the inferior orbital fissure to facilitate orbital dissection. These tissues should first be cauterized with bipolar electrocoagulation to prevent bleeding when incised.

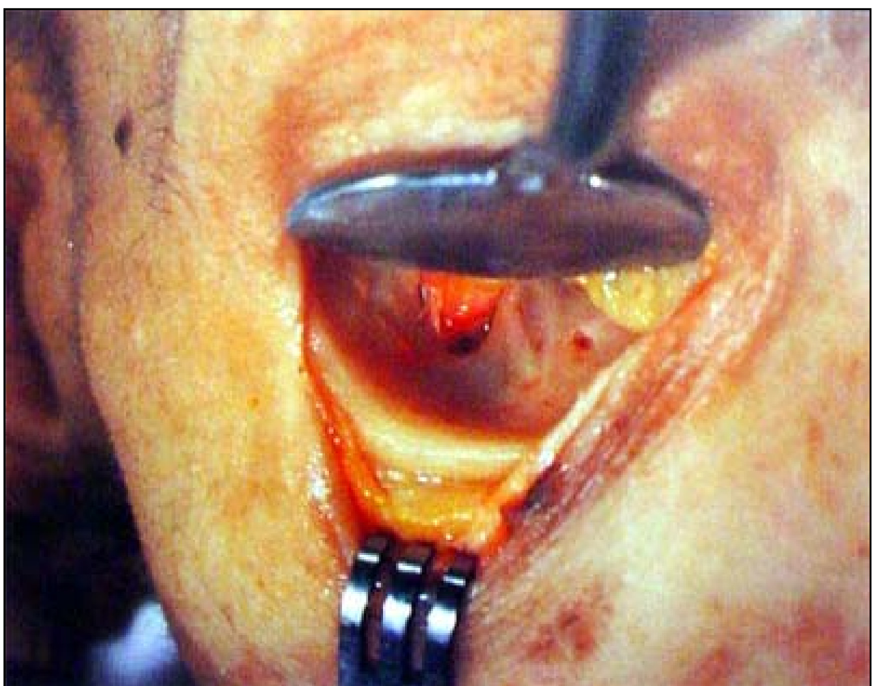


Figure 2-26 Anatomic dissection showing increased exposure of orbit after incision of contents of inferior orbital fissure.

Step 10. Closure

Closure is usually performed in two layers - the periosteum and skin (Fig.2-27). Suturing of the orbicularis oculi muscle is difficult and of little value. Interrupted or running ressorbable periosteal sutures, such as 5-0 catgut, ensure that the soft tissue stripped from the anterior surface of the maxilla and zygoma are repositioned. A 6-0 nonresorbable or fast-resorbing suture is then run along the skin margin. If a lateral extension was made, one should place one or two deep resorbable sutures in the incised orbicularis oculi muscle overlying the lateral orbital rim.

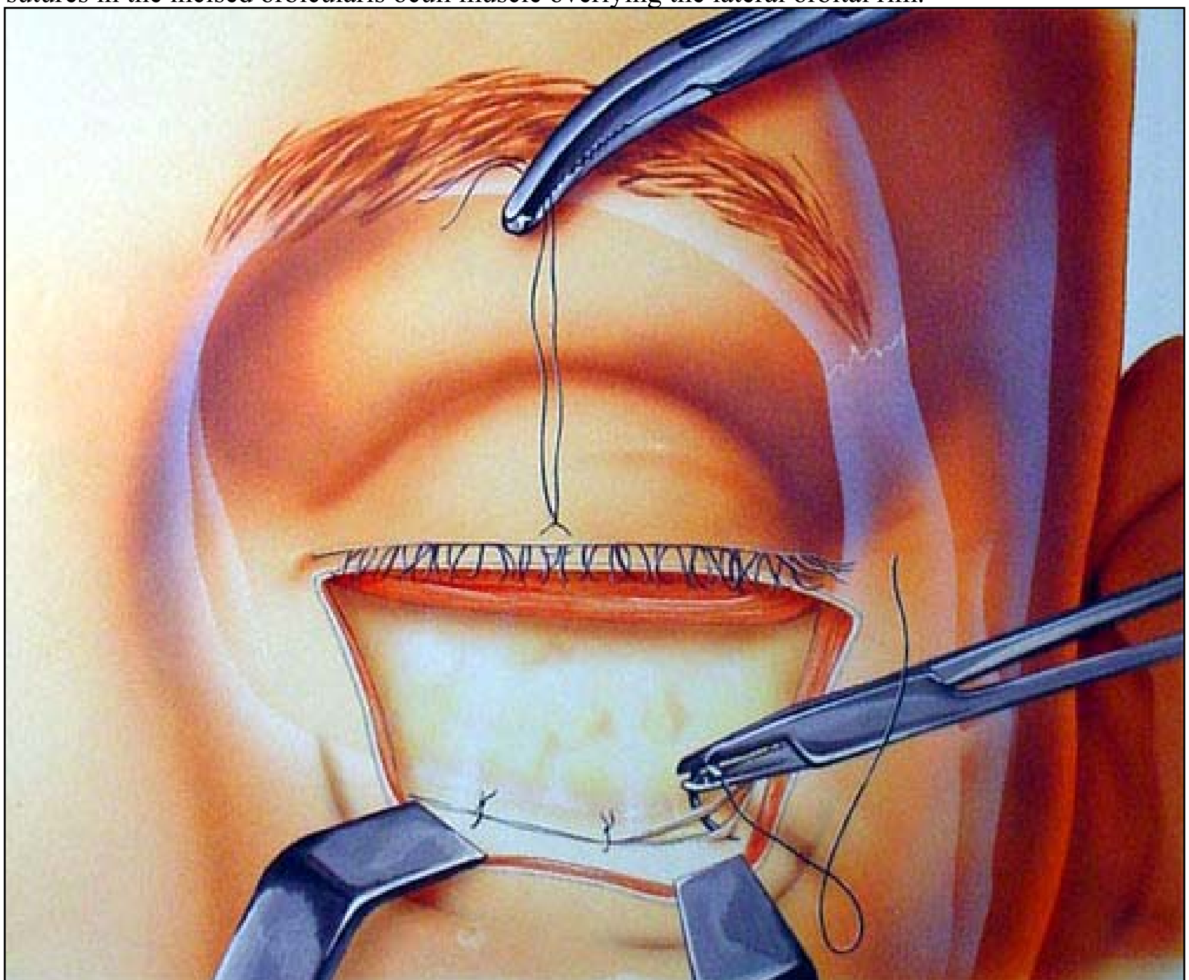


Figure 2 27 Closure of periosteum with interrupted resorbable sutures.

Step 11. Suspensory Suture for Lower Eyelid

One problem that may accompany any incision to gain access to the infraorbital rim and orbital floor is a vertical shortening of the lower lid after healing. This probably occurs as a result of scarring and shortening of the orbital septum. To reduce the incidence of this problem, superior support of the lower lid for several days (or until gross edema has resolved) after surgery is beneficial. The most direct method involves the use of a suture placed through the skin surface of the lower lid just inferior to the gray line that is taped to the forehead (Fig. 2-28). This lifts and supports the lower eyelids in a lengthened position, and helps dissipate lid edema. One may examine the globe and vision simply by removing the tape from the forehead and opening the eyelids. To maintain gentle upward support to the lower eyelid, it is important that the suture be taped to prevent if from slipping. To accomplish this, a three-tape technique has proven effective. The first layer of tape is attached to the skin as a base. The suture is then drawn over the first layer and a second layer of tape applied, with the suture held to the base layer of tape. The suture, however, can still slip between the two layers of tape. To prevent this, the suture is drawn inferiorly over the face of the second layer of tape, and a third layer of tape is then placed over the second.

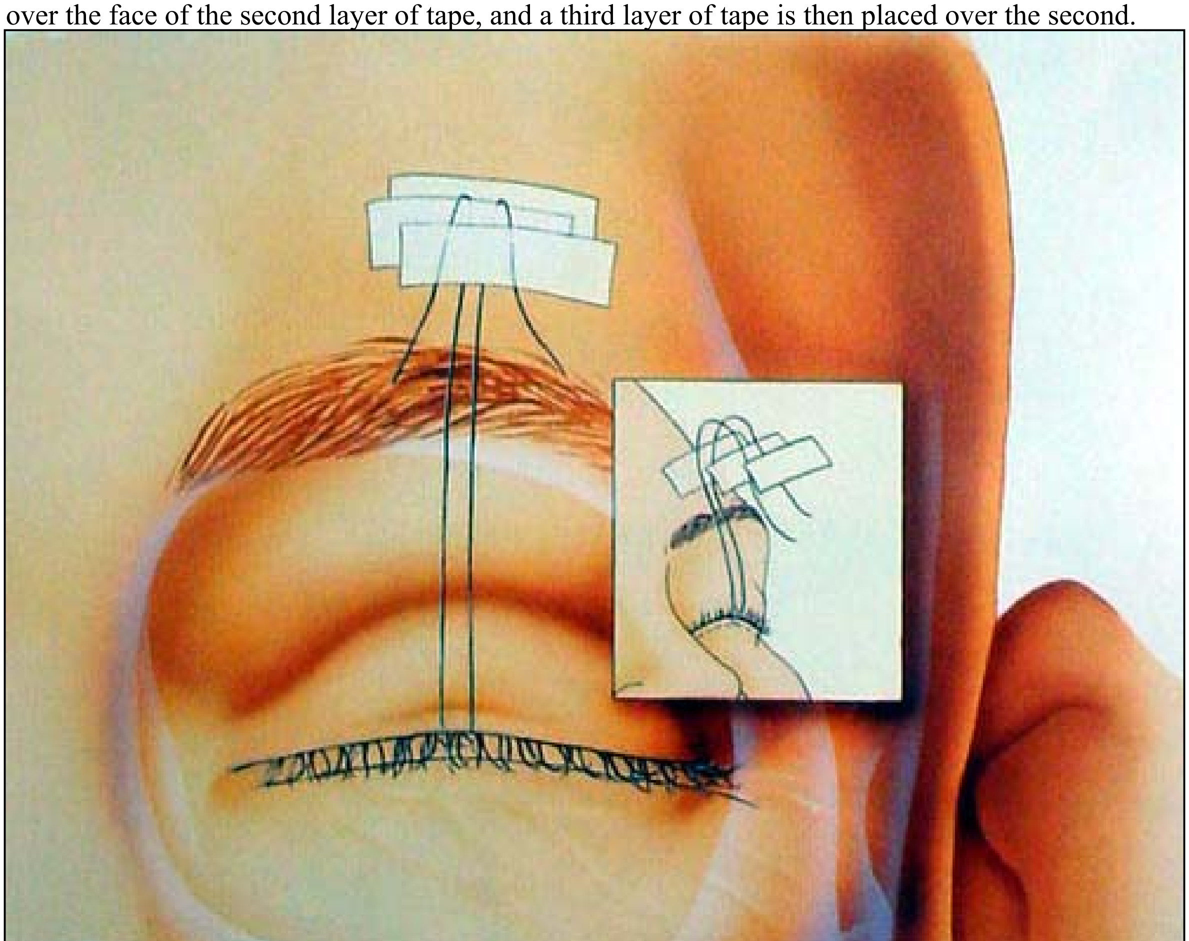


Figure 2-28 Lower eyelid suspensory suture placed at completion of surgery. The suture is placed just below the lower eyelashes (just above the subciliary incision), taking care to engage the tarsal plate. it is taped to the forehead in the manner shown to provide firm suspension.

ALTERNATIVE TECHNIQUE: EXTENDED LOWER EYELID APPROACH

The extended lower eyelid approach provides access to the entire lateral orbital rim to a point approximately 10 to 12 mm superior to the frontozygomatic suture. For this added exposure, however, amore generous incision and wide undermining are necessary. Additionally, the lateral canthal tendon must be stripped from its insertions and carefully repositioned. In spite of these concerns, the approach is useful when one requires access to the entire lateral orbit, lateral orbital rim, orbital floor, and inferior orbital rim.

The incision for the "extended" subciliary approach is exactly as described for the standard subciliary incision, but the incision must be extended laterally approximately 1 to 1,5 cm in a natural crease (see Fig. 2-13). If no natural skin crease extends laterally from the lateral palpebral fissure, the extension can usually be made straight laterally, or slightly inferolaterally.

Supraperiosteal dissection of the entire lateral orbital rim is performed with scissor dissection to a point above the frontozygomatic suture (Fig. 2-29). The orbicularis oculi musculature and superficial portion of the lateral canthal tendon are retracted as the dissection proceeds.

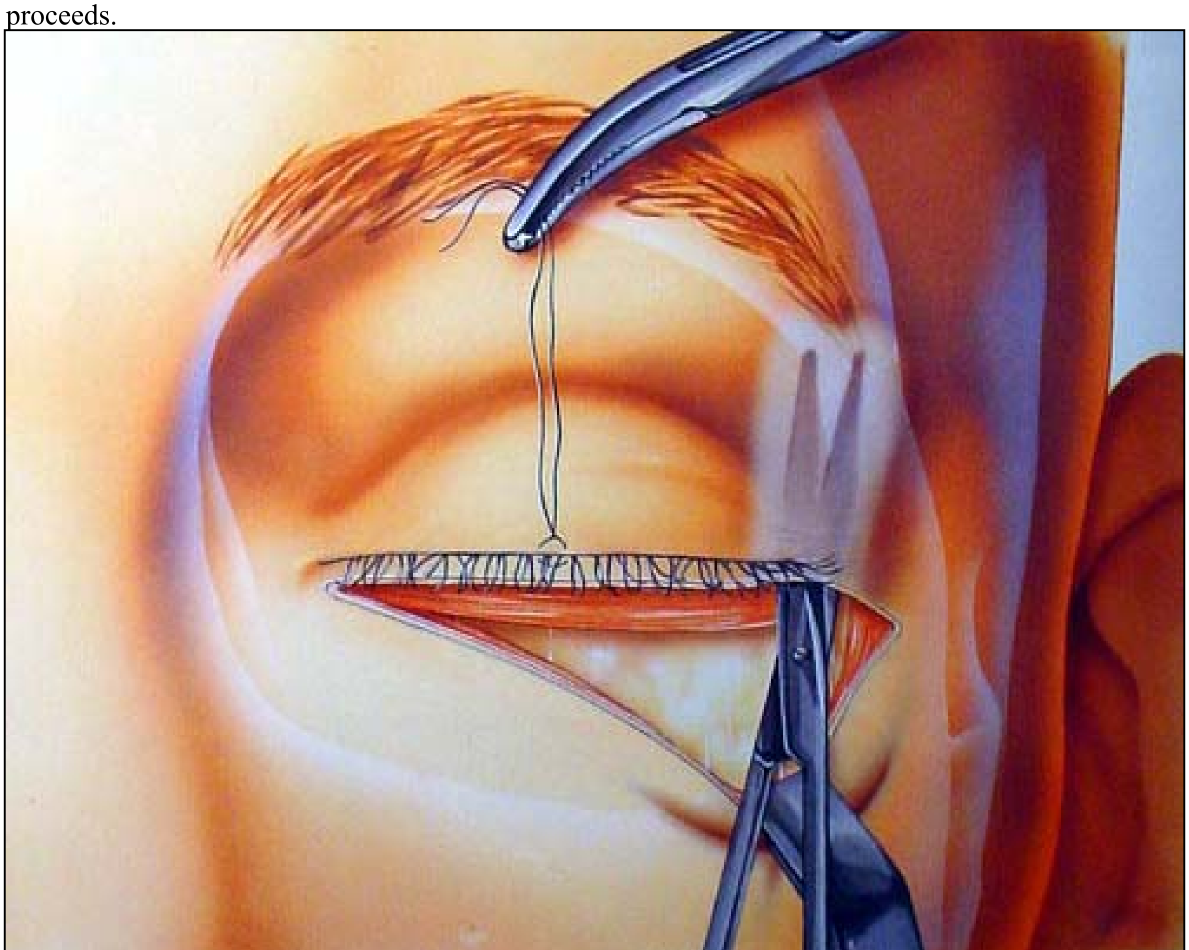


Figure 2-29 Technique used to obtain increased exposure of the lateral orbital rim. The initial incision is extended laterally 1 to 1,5 cm, and supraperiosteal dissection along the lateral orbital rim proceeds

With retraction, an incision through the periosteum 2 to 3 mm lateral to the lateral orbital rim is made from the highest point obtained with supraperiosteal dissection (Fig. 2-30). The periosteal incision is connected to the one described from the standard approach to the orbital floor and infraorbital rim (see previous text). Subperiosteal dissection must strip all of the tissue from the orbital floor and lateral orbital wall. This includes stripping the insertions of the deep portion of the lateral canthal tendon, Lockwood's suspensory ligament, and the lateral check ligament, from the orbital (Whitnall's) tubercle of the zygoma. Generous subperiosteal dissection deep into the lateral orbit allows retraction of these tissues to expose the frontozygomatic suture.

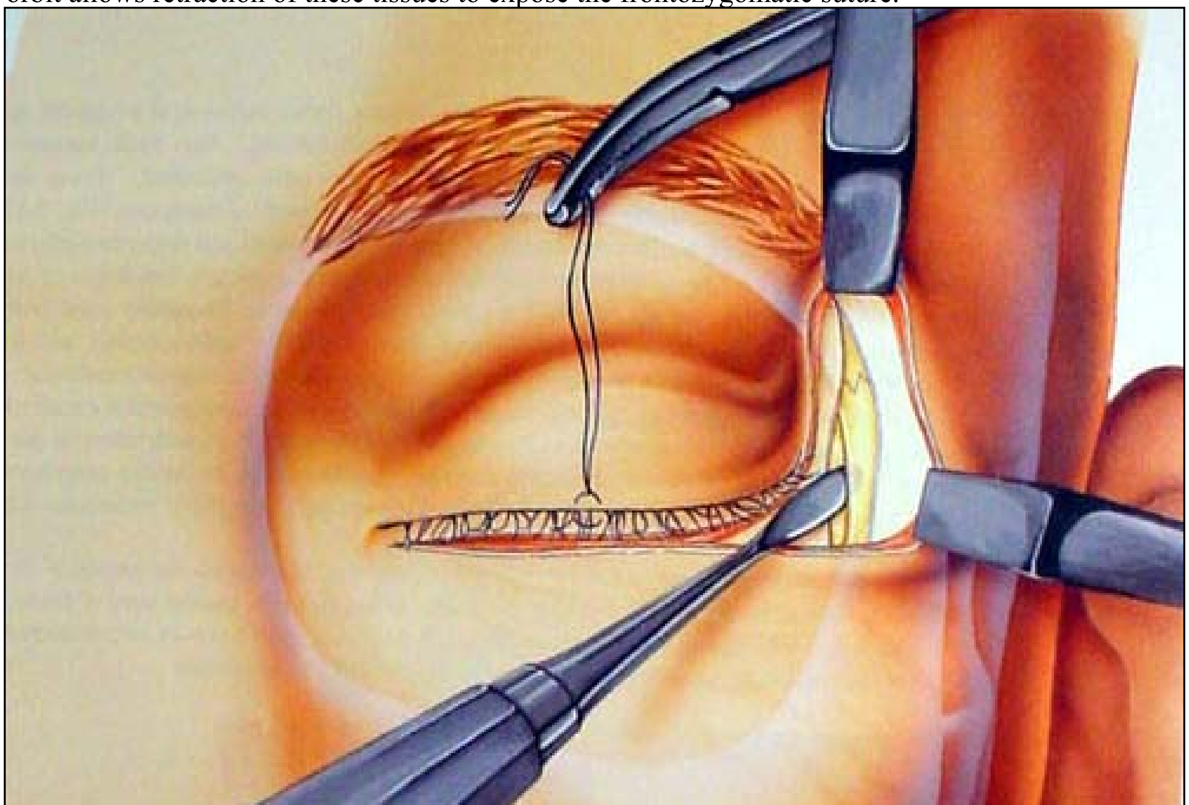


Figure 2 30 Dissection to the level of the frontozygomatic suture. The tissues superficial to the periosteum are retracted superiorly with a small retractor and an incision through periosteum is made 3 to 4 mm lateral to the lateral orbital rim. Subperiosteal dissection exposes the entire lateral orbital rim. Dissection into the lateral orbit frees the tissues and allows retraction superiorly.

No lateral canthopexy is necessary if careful repositioning and suturing of periosteum along the lateral orbital rim are performed. This maneuver brings the superficial portion of the lateral canthal tendon into proper position, giving the lateral palpebral fissure satisfactory appearance.

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4. Rodriguez RL, Zide BM : Reconstruction of the medial canthus. Clin Plast Surg 15:255, 1988.

3 Transconjunctival Approach

The transconjuntival incision, also called the inferior fornix incision, is a popular approach for exposure of the orbital floor and infraorbital rim. Two basic transconjuntival approaches, the preseptal and retroseptal, have been described. These approaches vary in the relationship of the orbital septum to the path of dissection (Fig. 3-1). The retroseptal approach is more direct than the preseptal approach and easier to perform. The periorbital fat may be encountered during the retroseptal approach, but this is of little concern and causes no ill effects. A lateral canthotomy is frequently used with transconjunctival incisions for improved lateral exposure. The approach that will be demonstrated here is the retroseptal transconjunctival approach with a lateral canthotomy.

The main advantage of tranconjunctival approaches is that they produce excellent cosmetic results because the scar is hidden in the conjunctiva. If a canthotomy is performed in conjunction with the approach, the only visible scar is the lateral extension, which heals with an inconspicuous scar. Another advantage is that these techniques are rapid, and no skin or muscle dissection is necessary.

One disadvantage of the transconjunctival approach is that the medial extent of the incision is limited by the lacrimal drainage system. If access to the medial third of the orbital rim is needed, cutaneous approaches through the lower eyelid should be considered because they allow extension of the incision as far medially as necessary.

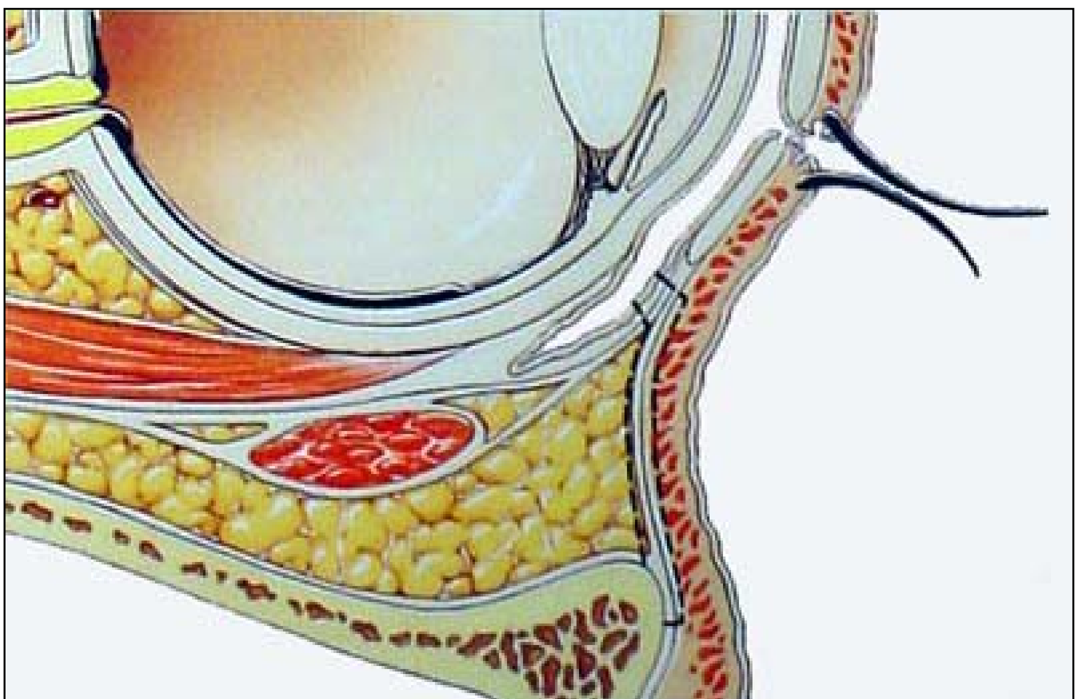


Figure 3 1 Sagital section through orbit showing preseptal and retroseptal placement of incision.

SURGICAL ANATOMY

Lower Eyelid

In addition to an understanding of the anatomy described in Chapter 2 for the lower eyelid approach, the transconjunctival approach requires understanding of a few additional matters.

Lower Lid Retractors. During full downward gaze, the lower lid descends approximately 2 mm in conjunction with movement of the globe itself. The inferior rectus muscle, which rotates the globe downward, simultaneously uses its fascial extension to retract the lower eyelid. This extension, which arises from the inferior rectus, contains sympathetic-innervated muscle fibers and is commonly called the capsulopalpebral fascia (Fig. 3-2). This fascia is incised during the transconjunctival approach to the orbit, but seems to be inconsequential from a clinical standpoint.

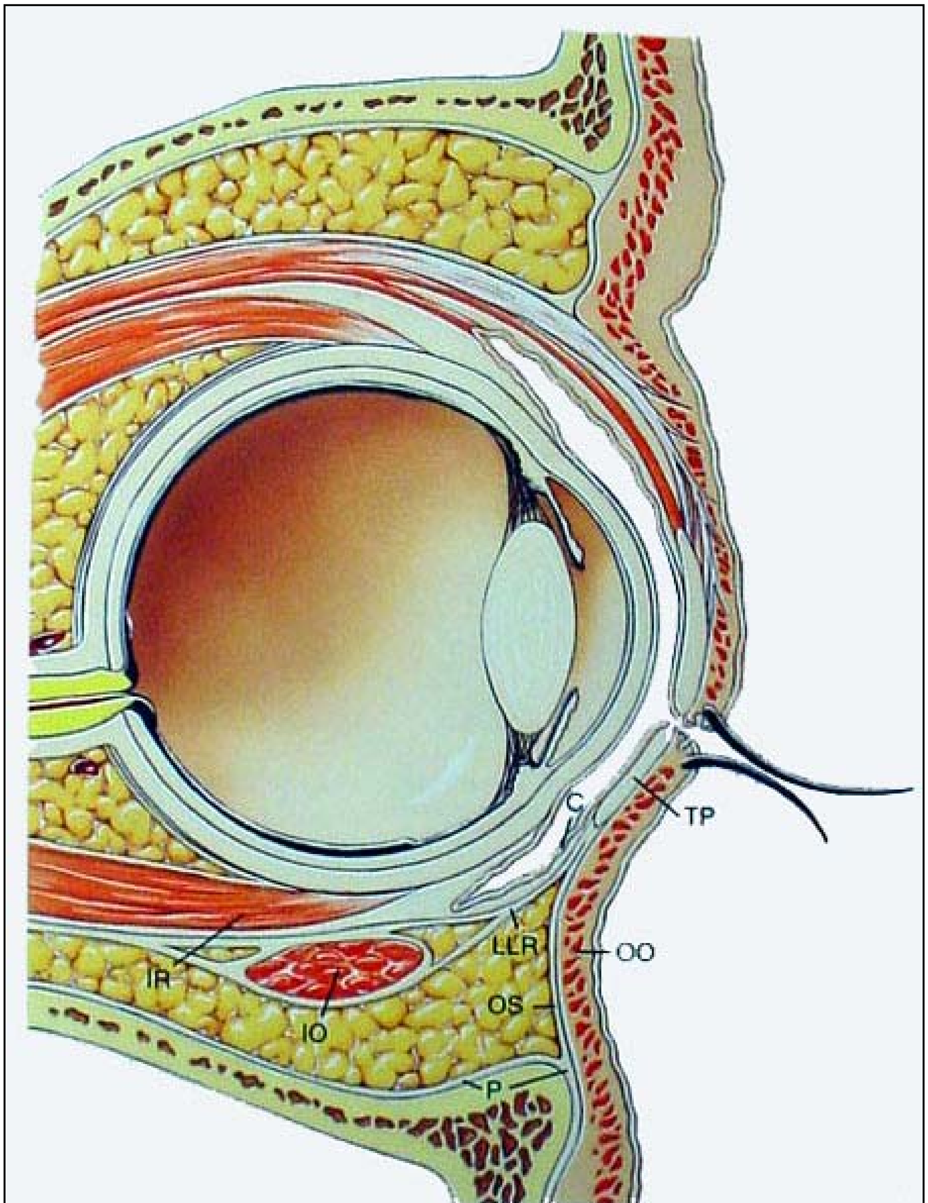


Figure 3 2 Sagital section through orbit and globe. C=palpebral conjunctiva; IO=inferior oblique muscle; IR=inferior rectus muscle; LLR=lower lid retractors; OO=orbicularis oculi muscle; OS=orbital septum; P=periosteum/periorbita; TP=tarsal plate.

TECHNIQUE

Step 1. Protection of the Globe

Protection of the cornea during operative procedures around the orbit is beneficial. Because tarsorrhphy is precluded with this approach, a corneal shield may be placed to protect the globe (Fig. 3-3).

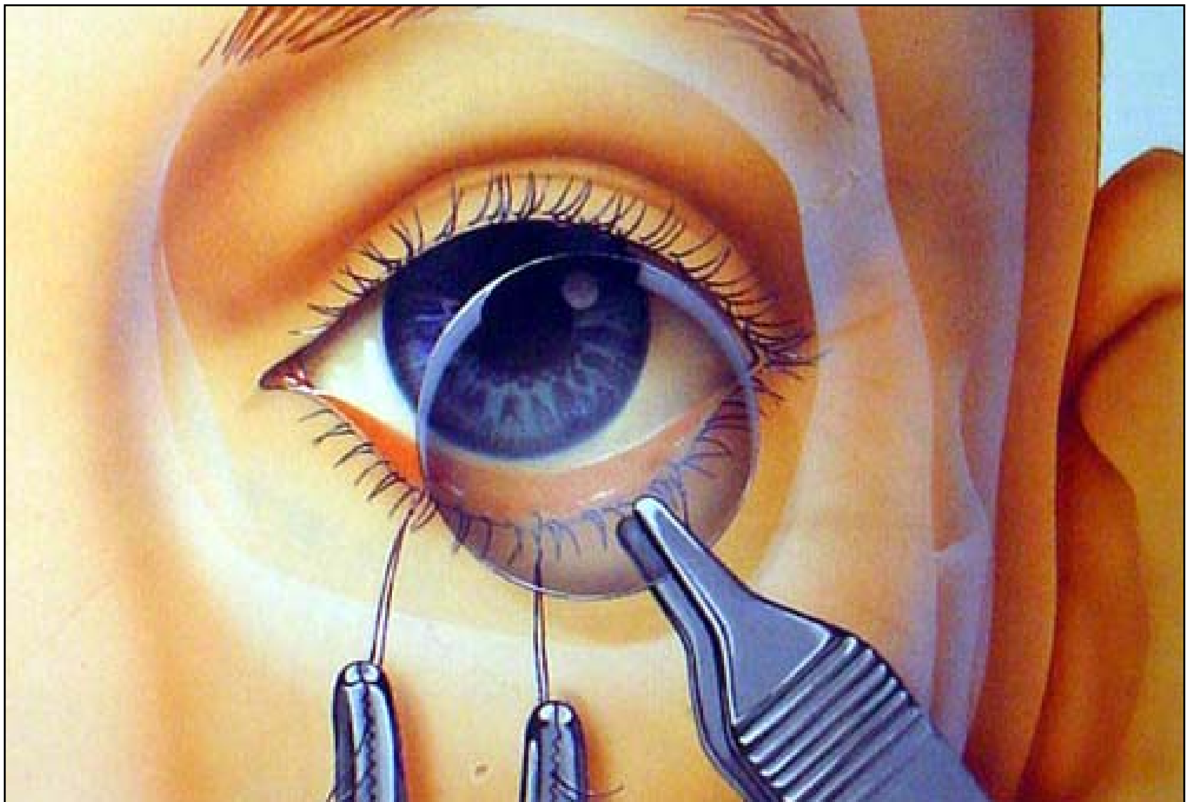


Figure 3 3 Placement of a corneal protector (shield). Two or three traction sutures placed through the lower lid assist in the placement of the shield and in subsequent surgery.

Step 2. Vasoconstriction

A vasoconstrictor can be injected under the conjunctiva to aid in hemostasis. A minimal amount is necessary. Additional solution is infiltrated in the area of the lateral canthotomy.

Step 3. Traction Sutures in Lower Eyelid

The lower eyelid is everted with fine forceps and two or three traction sutures are placed through the eyelid (see Fig. 3-3). These should be placed stright through the eyelid, from palpebral conjunctiva to skin, approximately 4 to 5 mm below the lid margin to ensure that the tarsal plate is included in the suture.

Step 4. Lateral Canthotomy and Inferior Cantholysis

If a lateral canthotomy is used, the approach begins with it. One tip of pointed scissors is placed inside the palpebral fissure, extending laterally to the depth of the underlying lateral orbital rim (approximately 7 to 10 mm). The scissors are used to cut horizontally through the lateral palpebral fissure (Fig. 3-4). The structure cut in the horizontal plane are skin, orbicularis muscle, orbital septum, lateral canthal tendon, and conjunctiva.

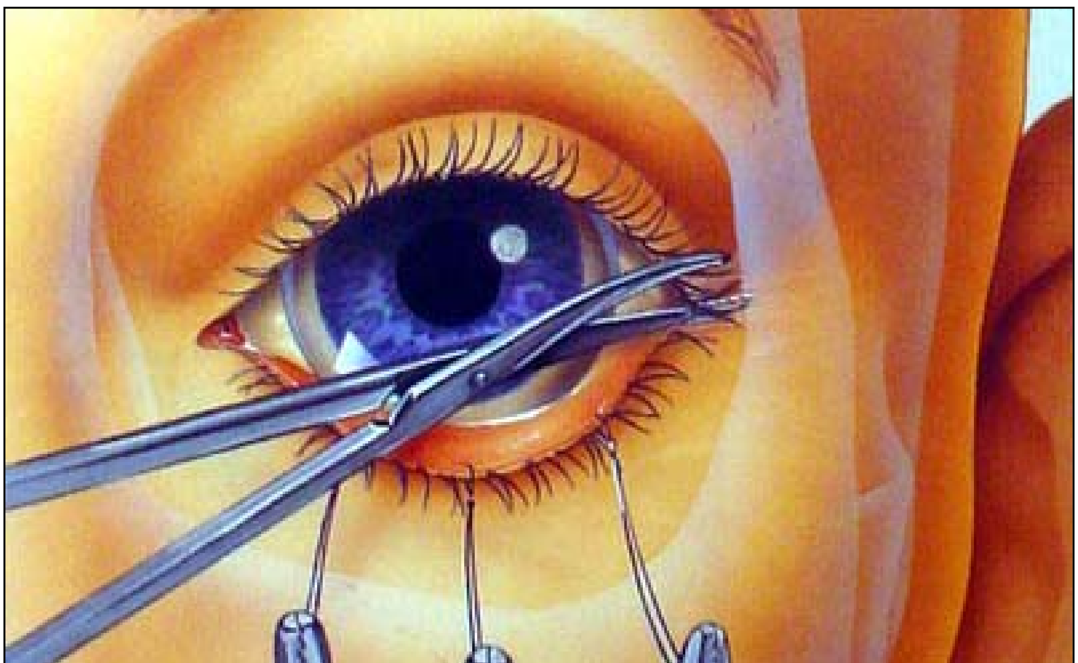


Figure 3 4 Initial incision for lateral canthotomy.

The traction sutures are used to evert the lower lid. Note that the lower lid is still tethered to the lateral orbital rim by the inferior limb of the lateral canthal tendon (Fig. 3-5). This is isolated by retraction and incised with scissors. To perform the contholysis, the scissors will need to be positioned with a vertical orientation (Fig. 3-6). Once the cantholysis is complete, an immediate release of the lower lid from the lateral orbital rim is noted (Fig. 3-7). The surgeon will be able to evert the lower lid more effectivelly.

Figure 3 5 Anatomic dissection shoing result after initial canthopexy illustrated in Figure 3-3. Note that the inferior limb of the lateral canthal tendon (*) is still attached to the lower tarsus, preventing mobilization.

Figure 3 6 Technique of inferior cantholysis.

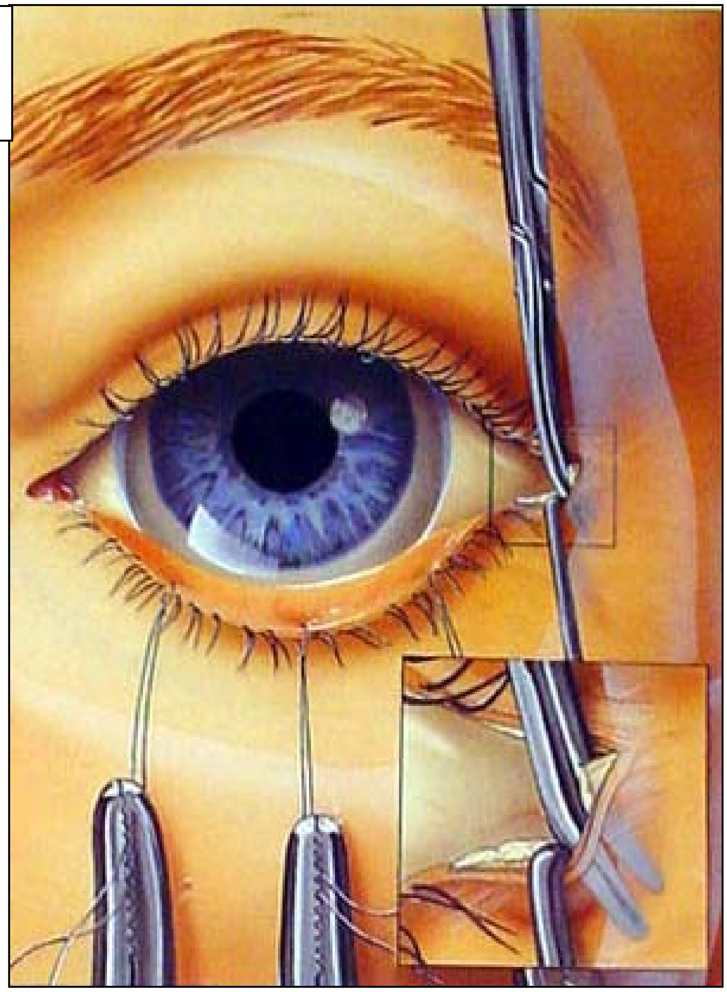


Figure 3 7 Anatomic dissection shoing rsult after cantholysis illustrated in Figure 3-5. Note that the inferior limb of the lateral canthal tendon (*) has been severed, allowing the lower lid great mobility.

Step 5. Transconjunctival Incision

Once the lower lid is everted, note the position of the lower tarsal plate through the conjunctiva. Blunt-tipped pointed scissors are used to dissect through the small incision through the conjunctiva made during the lateral canthotomy, inferiorly toward the infraorbital rim. The traction sutures are used to evert the lower eyelid during the dissection. Spread the scissors to clear a pocket just posterior to the orbital septum, ending just posterior to the orbital rim (Fig. 3-8).

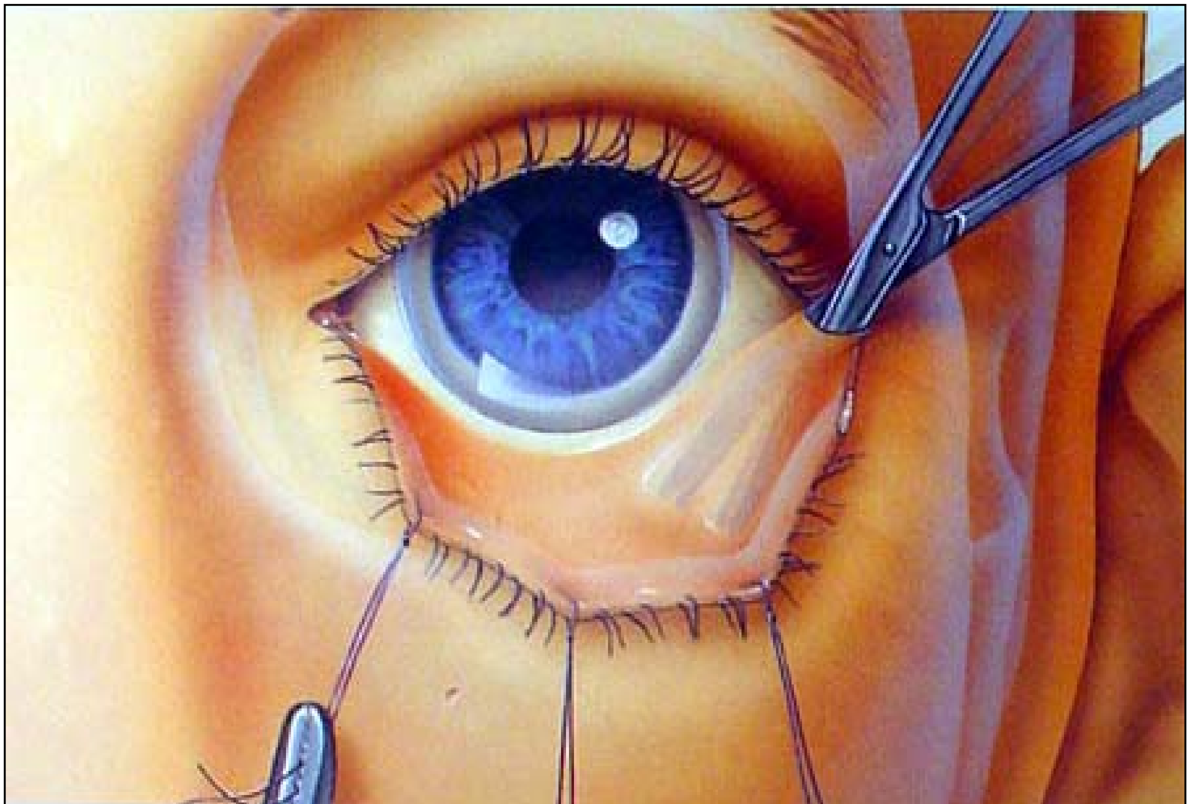


Figure 3 8 Scissors placed into the initial canthopexy incision to dissect in the subconjunctival plane. The dissection should be just below the tarsal plate and extend no farther medially than the lacrimal punctum. Note how the traction sutures through the lower lid assist in this dissection.

Scissors are used to icise the conjunctiva and lower lid retractors midway between the inferior margin of the tarsal plate and the inferior conjunctival fornix (Figs. 3-9 and 3-10). The incision should not extend farther medially than the lacrimal punctum. A traction suture through the cut edge of the bulbar conjunctiva can be placed to assist in retraction and to hold the corneal shield in place (Fig. 3-11).

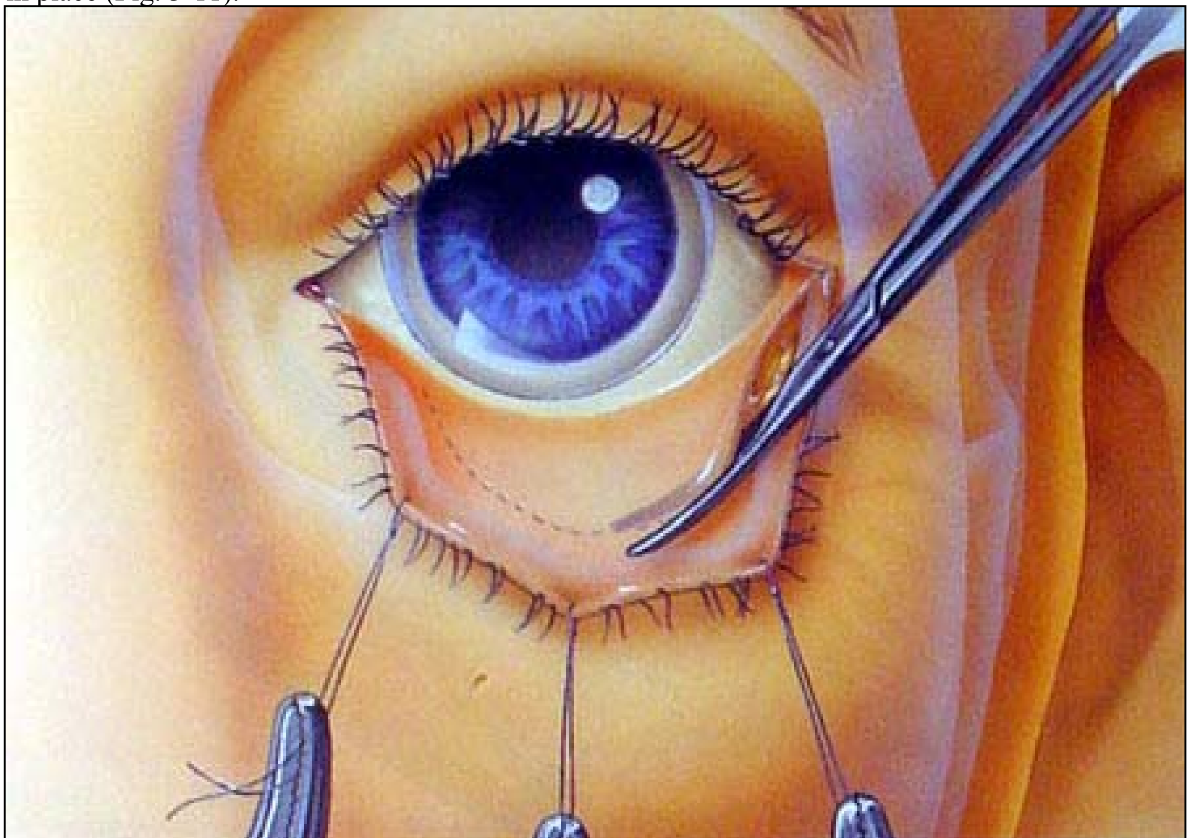


Figure 3 9 Incision of the conjunctiva below the tarsal plate.

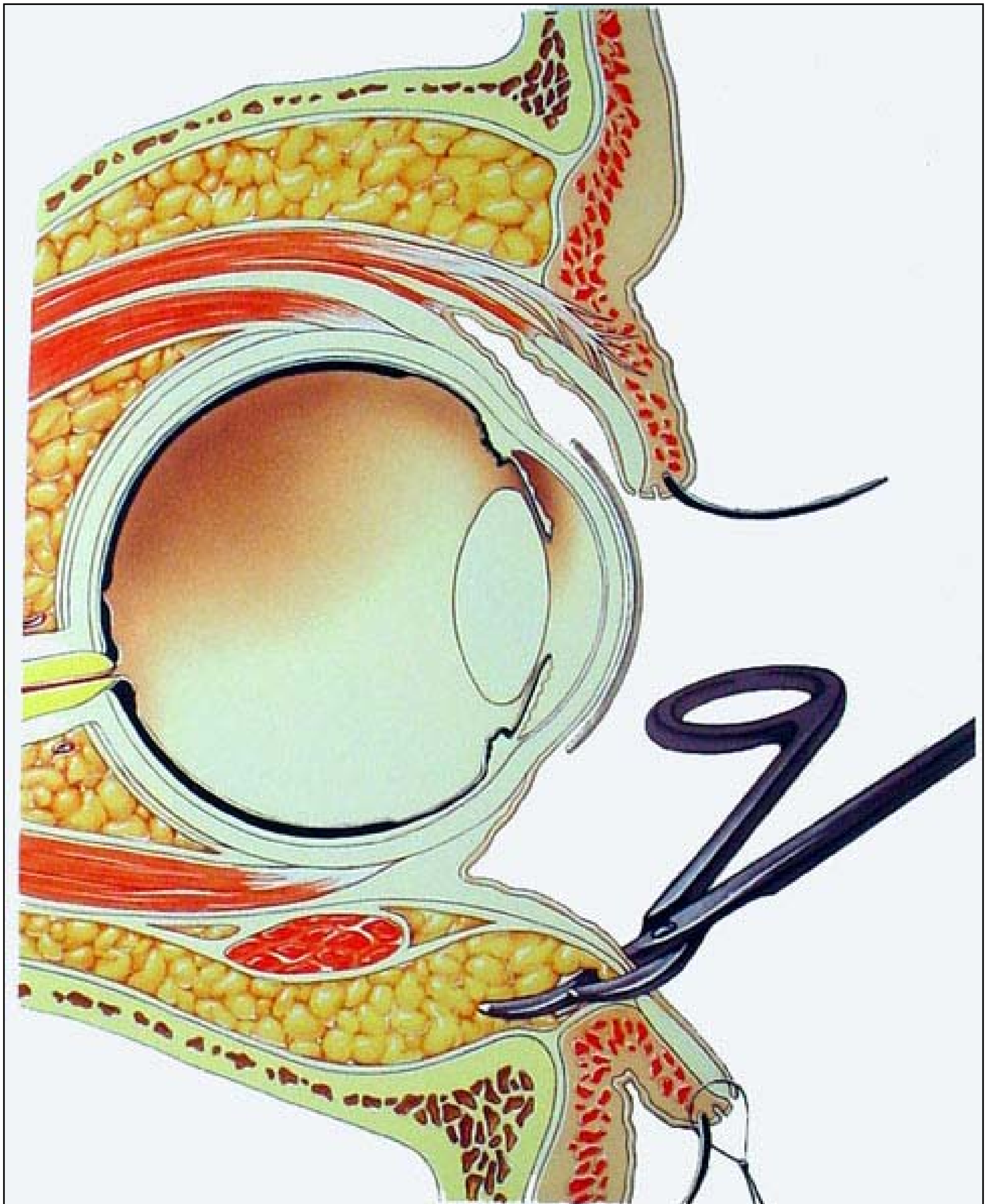


Figure 3 10 Sagital plane through the orbit and globe demonstrating level and plane of incision. The conjunctiva and lower lid retractors are incised with scissors.

Step 6. Periosteal Incision

With retraction of the orbital contents and the lower lid, using suitable retractors, a scalpel is used to icise the periorbita, taking care to stay lateral to the lacrimal sac (Fig. 3-11). The incision through the periorbita is just posterior to the orbital rim when the retroseptal approach is used.

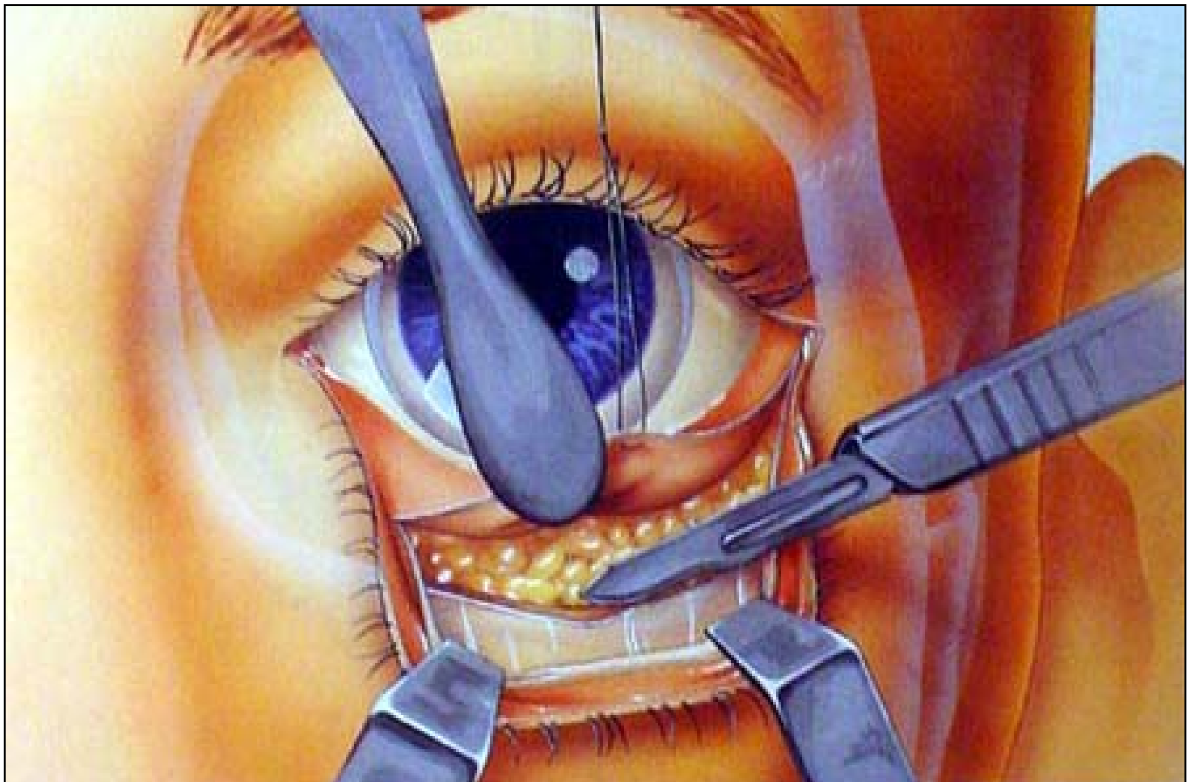


Figure 3 11 Incision through periosteum. To facilitate this maneuver, a traction suture is placed through the cut end of the conjunctiva to retract the tissue and maintain the position of the corneal shield. Small retractors are placed so that the lower lid is retracted to the level of the anterior surface of the infraorbital rim. A broad retractor is placed just posterior to the infraorbital rim, confinig the orbital fat. The intervening tissue along the infraorbital rim is the periosteum. The incision is made through the periosteum just posterior to the infraorbital rim.

Step 7. Subperiosteal Orbital Dissection

Periosteal elevators are used to strip the periosteum over the orbital rim and anterior surface of the maxilla and zygoma, and orbital floor (Fig. 3-12). A broad malleable retractor should be placed as soon as feasible to protect the orbit and to confine any herniating periorbital fat.

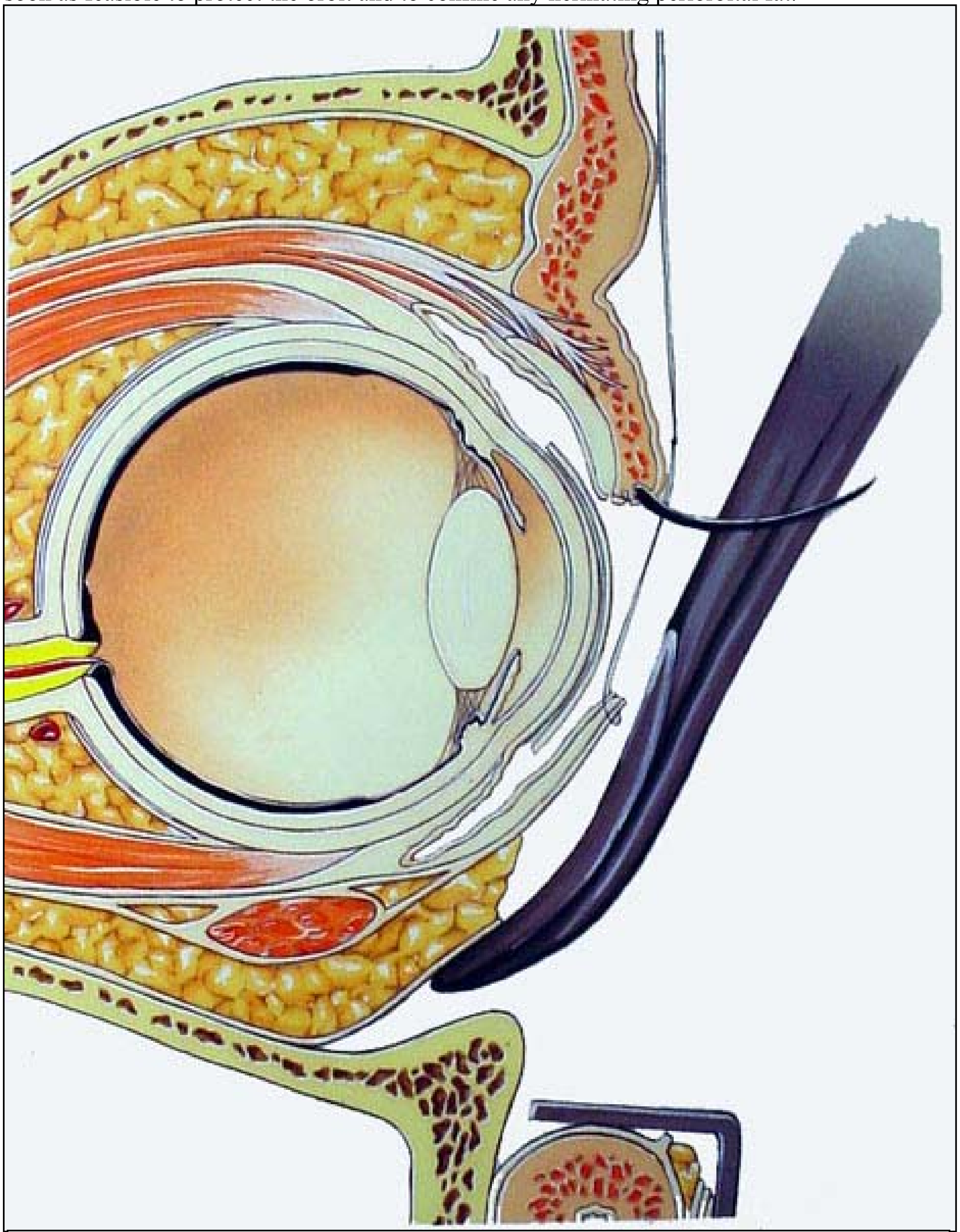


Figure 3 12 Subperiosteal dissection of the orbital floor. Note the traction suture placed through the cut end of the conjunctiva, which assists in retracting the conjunctiva and maintains the corneal shield in place.

Step 8. Closure

Periosteal sutures are not absolutely necessary, but if exposure permits, the can be placed, The conjunctiva is closed with a running 6-0 chromic gut suture. The ends of the suture may be buried. No attempt is made to reapproximate the lower lid retractors because they are intimately in contact with the conjunctiva and will be adequately repositioned with closure of that layer. Once the conjunctiva is closed, an inferior canthopexy is performed (Fig. 3-13).

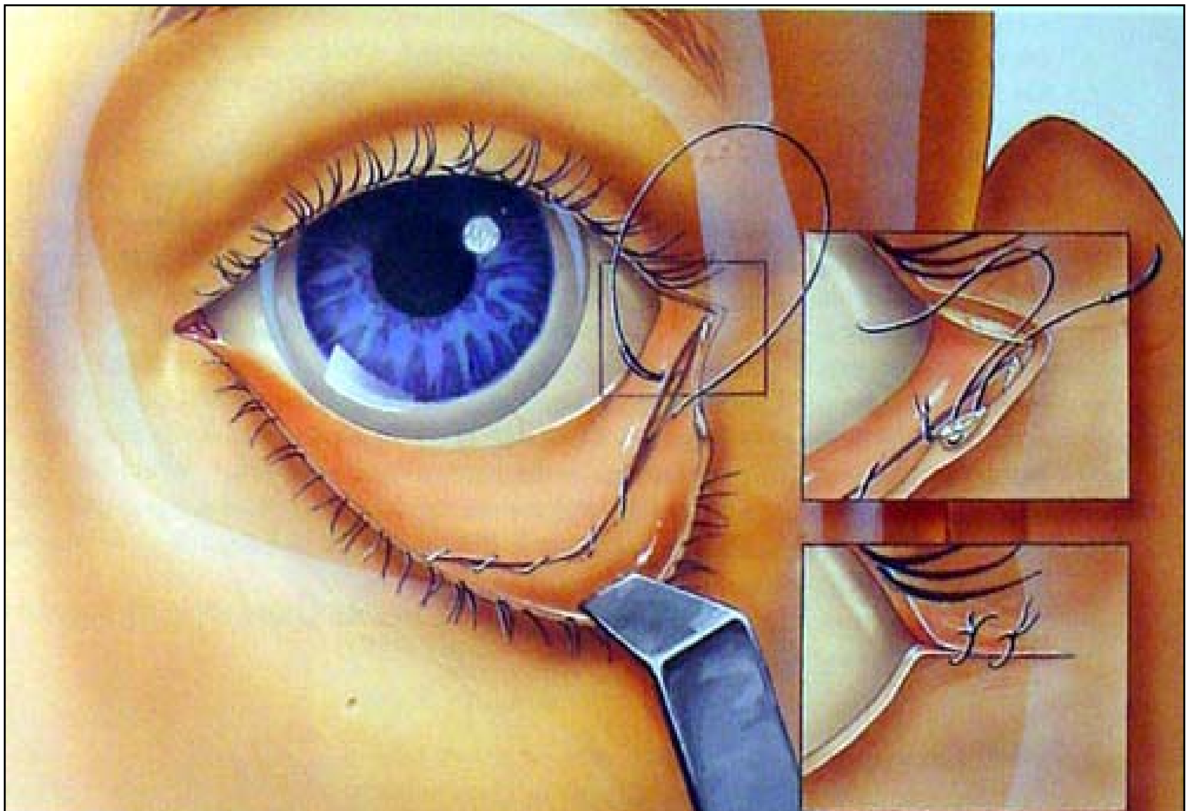


Figure 3 13 Closure of transconjunctival incision and inferior canthopexy. A running 6-0 gut suture is initially placed through the conjunctiva (and lower lid retractors). The inferior canthopexy suture is placed next, followed by skin sutures along the dermal canthotomy incision.

A 4-0 polyglactin or other long lasting suture is used to reattach the lateral portion of the inferior tarsal plate to the superior portion of the canthal tendon and surrounding tissues. It is important that this suture be securely placed in the appropriate location or the lateral canthal area will never appear normal. When the inferior limb of the canthal tendon is severed during the approach, only a minute amount of canthal tendon remains attached to the lower tarsus. Therefore the canthopexy suture can be placed through the lateral border of the tarsus if the tendon attached is insufficient to hold a suture. It is easier to pass the suture through the lateral border of the lower tarsus and/or cut portion of the lateral canthal tendon if the skin is dissected slightly from them. This is very easily performed by taking a #15 scalpel and incising between the tarsus and the skin. A cleavage plane exists in this location, and the tissue readily separates. The tarsus is grasped with forceps and a suture is passed through either the cut tendon or the lateral border of the tarsus in such a fashion that a firm bit of tissue is engaged. Once a goode bite of lower tarsus has been taken with the suture, the suture needle should be placed through the superior limb of the lateral canthal tendon.

The bulk of the lateral canthal tendon attaches to the orbital tubercle, 3 to 4 mm *posterior* to the orbital margin. Following canthotomy, the superior limb of the canthal tendon is still attached to the orbital tubercle. It is important to place the suture as deep behind the orbital rim as possible to adapt the lower eyelid to the globe. If the suture is not properly placed, the eyelid will not contact the globe laterally, giving an unnatural appearance. Therefore, the suture needle should pass very far posteriorly and superiorly to ensure that it grasps the superior limb of the tendon. An effective method to pass this suture is to identify the superior limb of the canthal tendon first with small, toothed forceps placed into the incision. The forceps are passe along the medial side of the lateral orbital rim for a few mm until the dense fibers of the superior limb are located. While the tendon is held, the suture needle is passed through the tendon. The surgeon should pull on the two ends of the suture to enclosure that the suture is firmly attached to ligamentous tissue. The suture is then tied, with the lower lid drawn into position.

Finally, subcutaneous sutures and 6-0 skin suture are placed along the horizontal lateral canthotomy.

4 Supraorbital Eyebrow Approach

SURGICAL ANATOMY

A previously popular incision used to gain access to the superolateral orbital rim is the eyebrow incision. No important neurovascular structures are involved in this approach, and it gives simple and rapid access to the frontozygomatic area. If the incision is made almost entirely within the confines of the eyebrow, the scar is usually imperceptible. Occasionally, however, some hair loss occurs, making the scar perceptible. Unfortunately, in individual who has no eyebrows extending laterally and inferiorly along the orbital margin, this approach is undesirable. Incisions made along the lateral orbital rim outside of the eyebrow are very conspicuous in such individuals, and another type of incision may be indicated. The main disadvantage of the approach is extremely limited access.

TECHNIQUE

Step 1. Vasoconstriction

A local anesthetic with a vasoconstrictor is injected into the subcutaneous tissues over the lateral orbital rim to aid in hemostasis.

Step 2. Skin Incision

The eyebrow is not shaved. The skin is straddled over the orbital rim using two fingers and a 2 cm incision is made. The incision should be parallel to the hair of the eyebrow to avoid cutting hair shafts. Which might retard growth of the eyebrow hair. The incision may be made to the depth of the periosteum in one stroke (Fig. 4-1). The skin is freely movable in this plane.

Access can be improved by extending the incision more anteriorly within the confines of the eyebrow. Extending the incision inferiorly along the orbital rim should be avoided because the incision crosses the lines of resting skin tension, making the scar very conspicuous. If more inferior exposure is required, the incision should extend laterally into a crow's foot wrinkle at least 6 mm above the level of the lateral canthus.

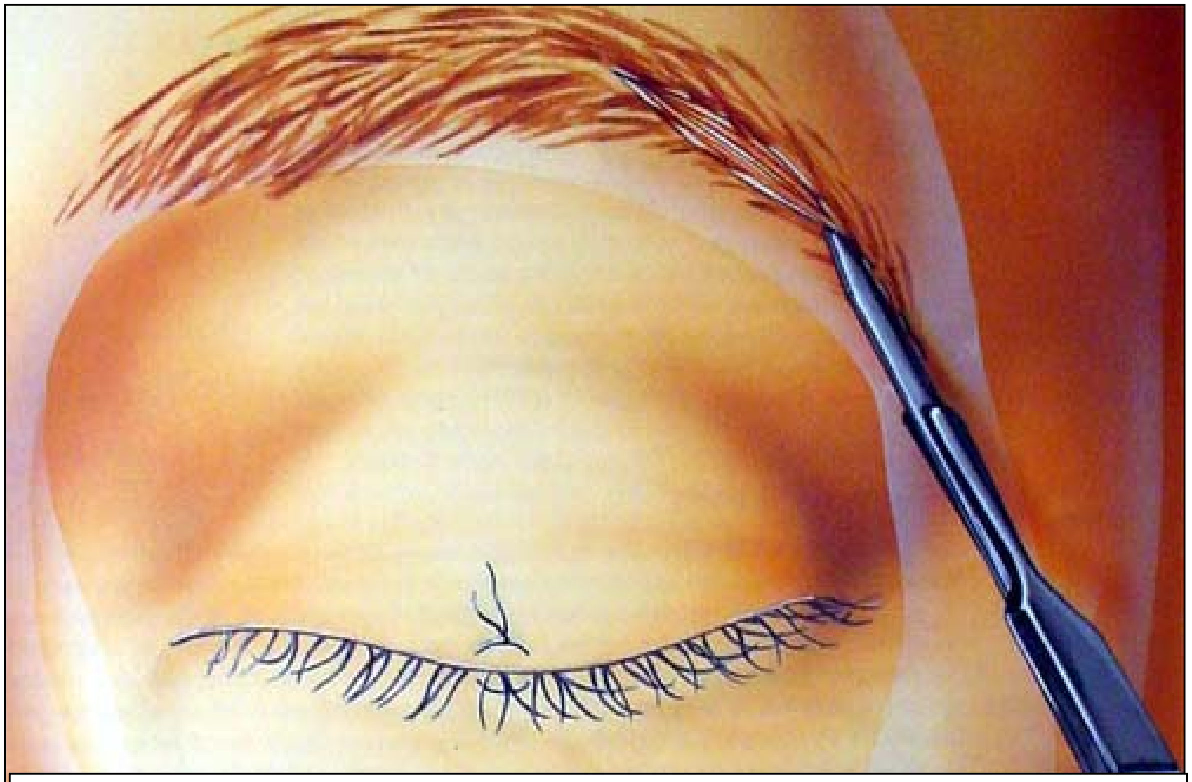


Figure 4 1 Placement of incision within confines of eyebrow hair. The incision is made through skin and subcutaneous tissue to the level of the periosteum in one stroke.

Step 3. Periosteal Incision

After undermining in the supraperiosteal plane, the skin is retracted until it is over the area of interest. Another incision through the periosteum completes the sharp dissection (Fig. 4-2).

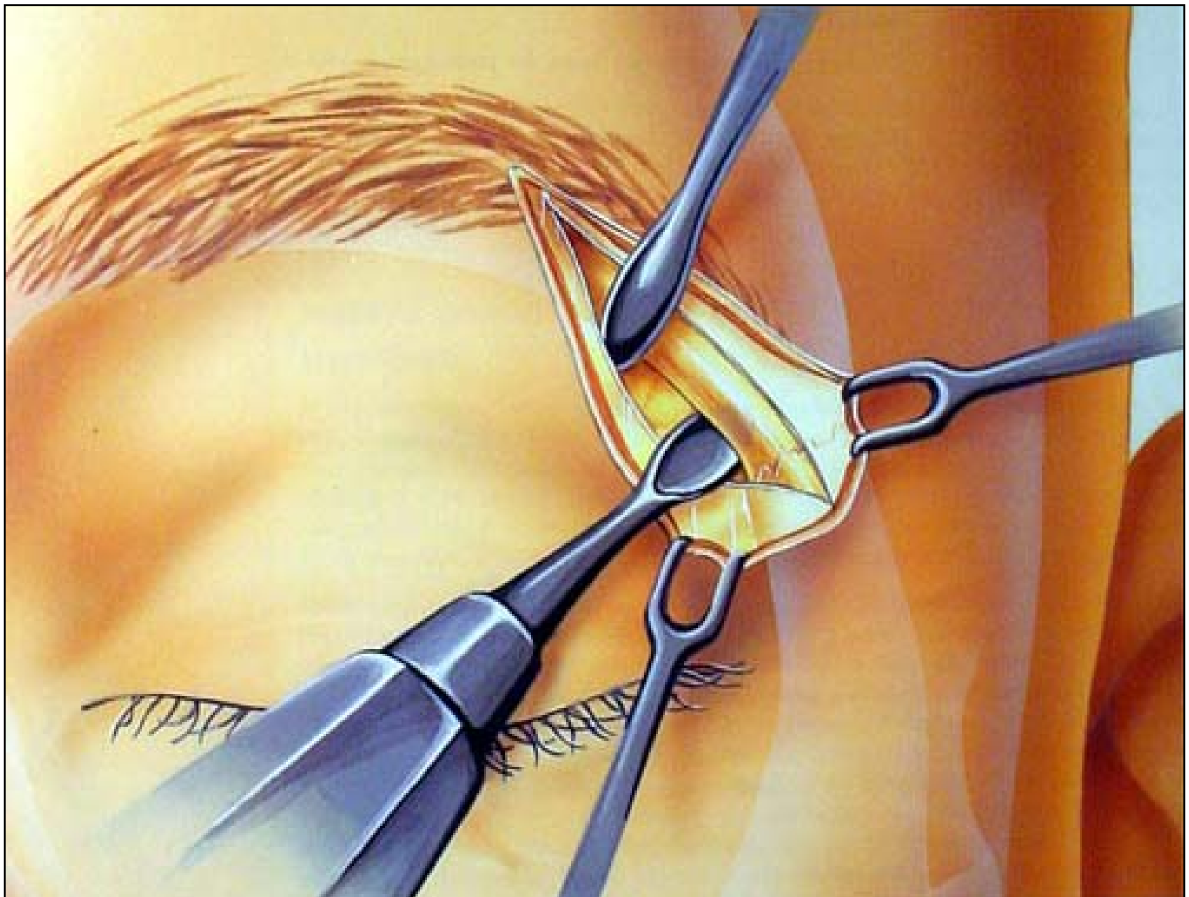


Figure 4 2 Incision through periosteum along lateral orbital rim and subperiosteal dissection into lacrimal fossa. Because of the concavity just behind the orbital rim in this area, the periosteal elevator is oriented laterally as dissection proceeds posteriorly.

Step 4. Subperiosteal Dissection of Lateral Orbital Rim and Lateral Orbit

Two sharp periosteal elevators are used to expose the lateral orbital rim on the lateral, medial (intraorbital), and, if necessary, posterior (temporal) surfaces (Fig. 4-2). Wide undermining of the skin and periosteum allows the tissues to be retracted inferiorly, providing better access to the lower portions of the lateral orbital rim. If one stays in the subperiosteal space, there is virtually no chance of damaging structures.

Step 5. Closure

The incision is closed in two layers, the periosteum and the skin.

5 Upper Eyelid Approach

The upper eyelid approach to the superolateral orbital rim is also called upper blepharoplasty, upper eyelid crease, and supratarsal fold approach. In this approach, a natural skin crease in the upper eyelid is used to make the incision. The advantage of this approach is the inconspicuous scar it creates, which makes it one of the best approaches to the region of the superolateral orbital complex.

SURGICAL ANATOMY

Upper Eyelid

In sagital section, the upper eyelid consists of at least five distinct layers: the skin, the orbicularis oculi muscle, the orbital septum above or levator palpebrae superioris aponeurosis below, Müller's muscle/tarsus complex, and the conjunctiva (Fig. 5-1). The skin, orbicularis oculi muscle, and conjunctiva of the upper eyelid are similar to those of the lower eyelid (see previous text). The upper eyelid differs from the lower eyelid, however, by the presence of the levator palpebral superioris aponeurosis and Müller's muscle.

Orbital Septum/Levator Aponeurosis Complex. Deep to the orbicularis oculi muscle lies the orbital septum/levator aponeurosis complex. Unlike the situation in the lower eyelid, where the orbital septum inserts into the tarsal plate, in the upper eyelid the orbital septum extends inferiorly and blends with the levator aponeurosis approximately 10 to 15 mm above the upper eyelid margin. The levator muscle usually becomes aponeurotic at the equator of the globe in the superior orbit. The aponeurosis courses anteriorly to insert onto the anterior surface of the lower two thirds of the tarsal plate. Extensions of the levator aponeurosis also extend anteriorly into the skin of the lower portion of the upper eyelid. The aponeurotic portion of the levator behind the orbital septum is much wider than the muscle from which it is derived, and its medial and lateral extensions are known as horns or cornua. The lateral horn is prominent and deeply indents the anterior portion of the lacrimal gland to divide it into thin palpebral and thick orbital portions; its lateral extension attaches to the orbital wall at the orbital (Whitnall's) tubercle. The weaker medial horn of the levator aponeurosis blends with the orbital septum and the medial check ligament.

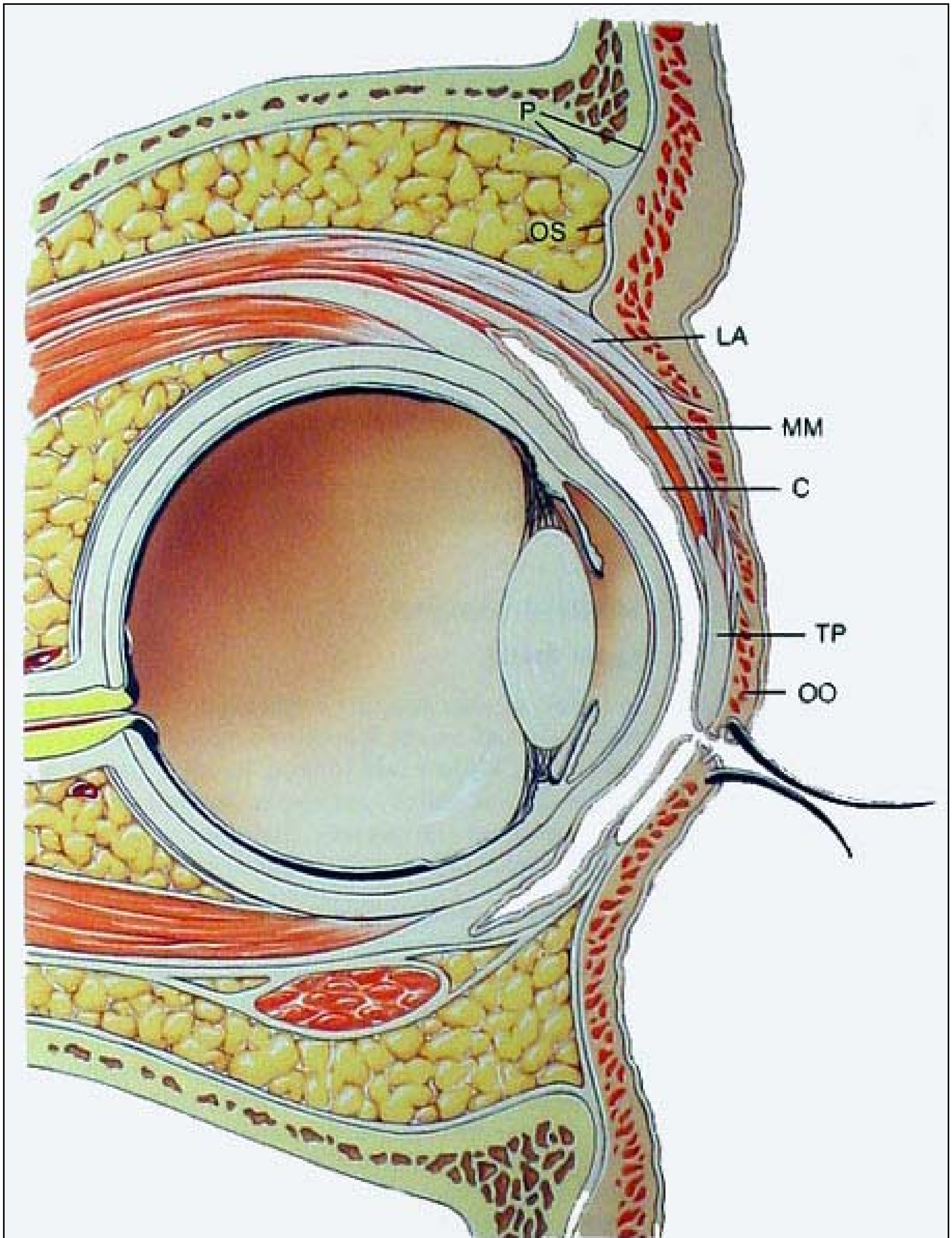


Figure 5 1 Sagittal section through orbit and globe. C=Palpebral conjunctiva; LA=levator palpebral superioris aponeurosis; MM=Müller's muscle; OO=orbicularis oculi muscle; OS=orbital septum;

Müller's Muscle/Tarsus Complex. Deep to the levator aponeurosis is Müller's muscle superiorly and the tarsus along the lid margin. Müller's muscle is a nonstriated, sympathetically innervated elevator of the upper eyelid. It takes its origin from the inner surface of the levator aponeurosis and inserts onto the superior surface of the upper tarsal plate. The *tarsal plate* of the upper eyelid is a thin, pliable fibrocartilaginous structure that gives form and support the upper eyelid. Embedded within the tarsal plate are large sebaceous glands, the tarsal or Meibomian glands. The edge of the tarsus adjacent to the free border of the lid parallels this, while the deeper (superior) border is curved so that the tarsus is somewhat semilunar in shape. It is also, of course, curved to conform the outer surface of the eyeball. The superior tarsus is considerably larger than the inferior one, the greatest height of the superior being about 10 mm and that of the inferior about 4 to 5 mm (see Figs. 2-5 and 2-6). The tarsal glands sandwiched between the layer of fibrocartilage in the upper eyelid exit on the lid margin near the lash follicles. The lashes are supported by their roots, attached to fibrous tissue on the tarsal plate, not in the orbicularis oculi muscle anterior to the tarsal plate. Laterally, the tarsal plate becomes a fibrous band that adjoins the structural counterpart from the lower lid, forming the lateral canthal tendon. Medially, the tarsal plate also becomes fibrous and shelters the superior lacrimal canaliculus behind as it becomes the medial canthal tendon.

TECHNIQUE

Step 1. Protection of Globe

Protection of the cornea during operative procedures around the orbit is an excellent precautionary measure. If one is operating on the skin side of the eyelids to approach the orbital rim and/or orbital floor, a temporary tarsorrhaphy or scleral shell may be used after apllication of a bland eye ointment. These are simply removed at the completion of the operation.

Step 2. Identification of and marking Incision Line

Carefully evaluate the skin creases around the orbit. If tissues are edematous, the skin surrounding the opposite orbit can be used to obtain an appreciation for the direction of creases. If a lid crease is not readily detectable, a curvilinear incision along the area of the supratarsal fold that tails off laterally over the lateral orbital rim works well. The incision should be similar in location and shape to the superior incision in a blepharoplasty (Fig. 5-2). The incision, however, may be extended farther laterally as necessary for surgical access. The incision should begin at least 10 mm superior to the upper lid margin and be 6 mm above the lateral canthus as it extends laterally. The incision line is marked *before* infiltration of a vasoconstrictor. The tissues distort following infiltration, and therefore a perceptible crease may disappear after injection.

Step 3. Vasoconstricton

Local anesthesia with a vasoconstrictor is injected under the eyelid skin and orbicularis oculi muscle along the incision line. Additional vasoconstrictor solution is injected supraperiosteally in the area to be surgically exposed.

Step 4. Skin Incision

The incision is through both skin and orbicularis oculi muscle (Fig. 5-2). The vaculature of the muscle maintains the viability of the skin when they are elevated together, and this leads to excellent healing.

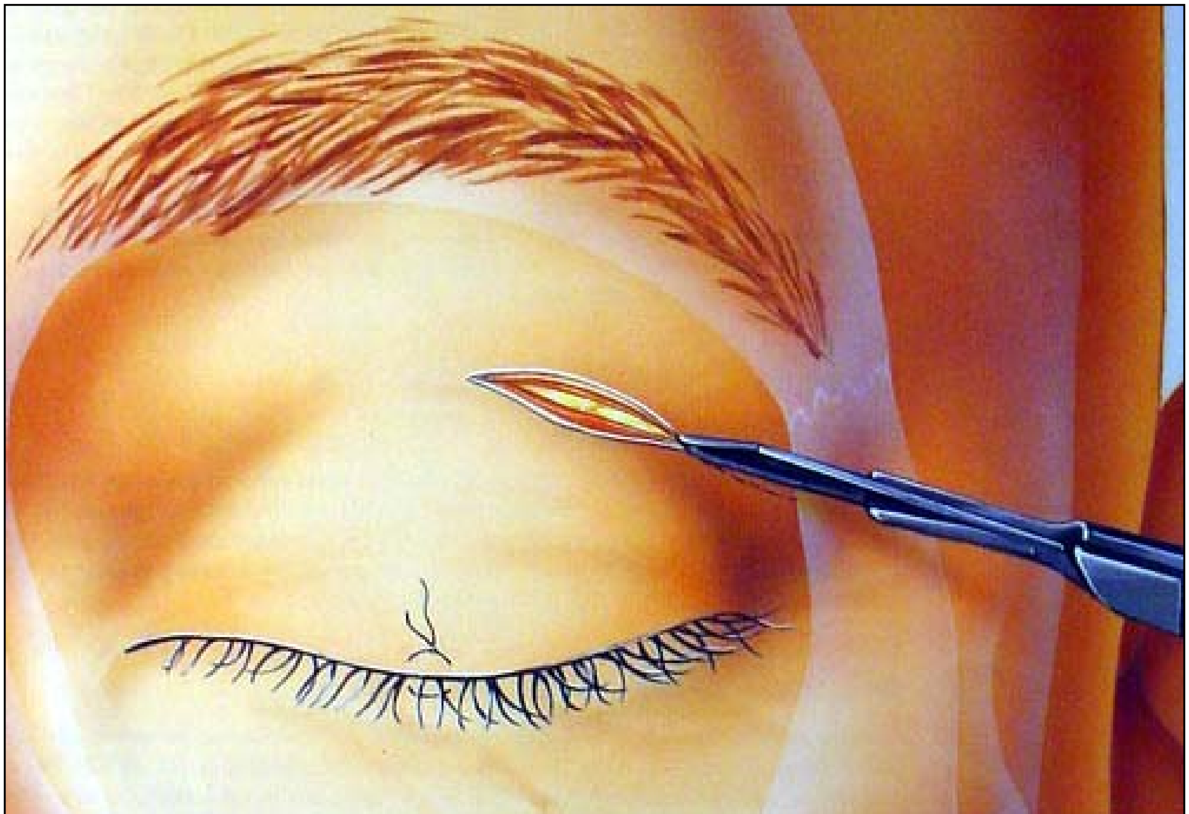


Figure 5 2 Position of incision. The incision may be extended farther laterally if necessary. The initial incision is made through skin and muscle.

Step 5. Underminig of Skin-Muscle Flap

A skin-muscle flap is developed superiorly, laterally, and if necessary, medially, using scissor dissection in a plane deep to the orbicularis oculi muscle (Fig. 5-3). The dissection is carried over the orbital rim, exposing the periosteum.

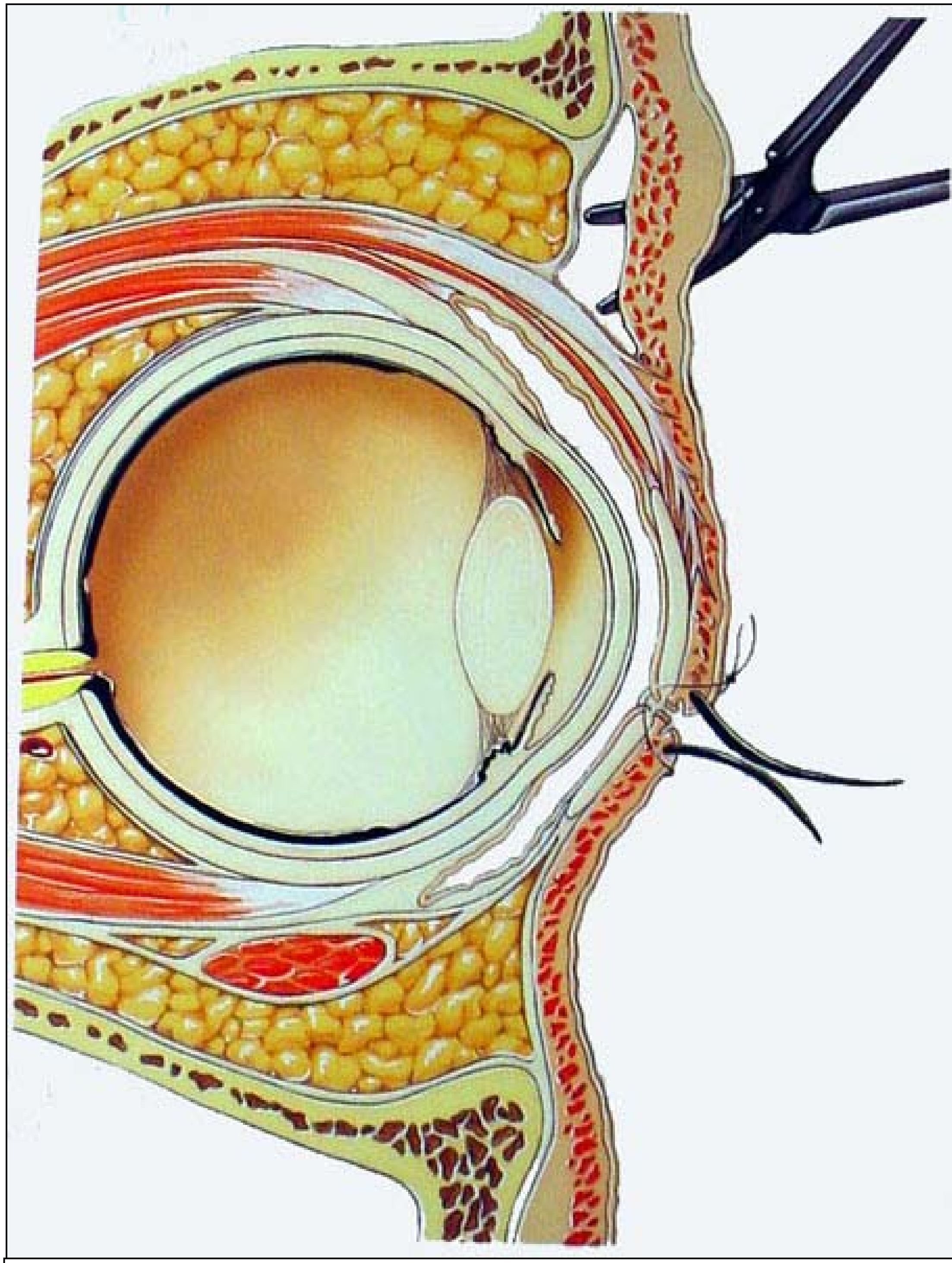


Figure 5 3 Sagittal section through orbit and globe showing dissection between orbicularis oculi muscle and the levator aponeurosis below and orbital septum above.

Step 6. Periosteal Incision

The skin-muscle flap is retracted until the area of interest is exposed. The periosteum is divided 2 to 3 mm posterior to the orbital rim with a scalpel (Fig. 5-4).

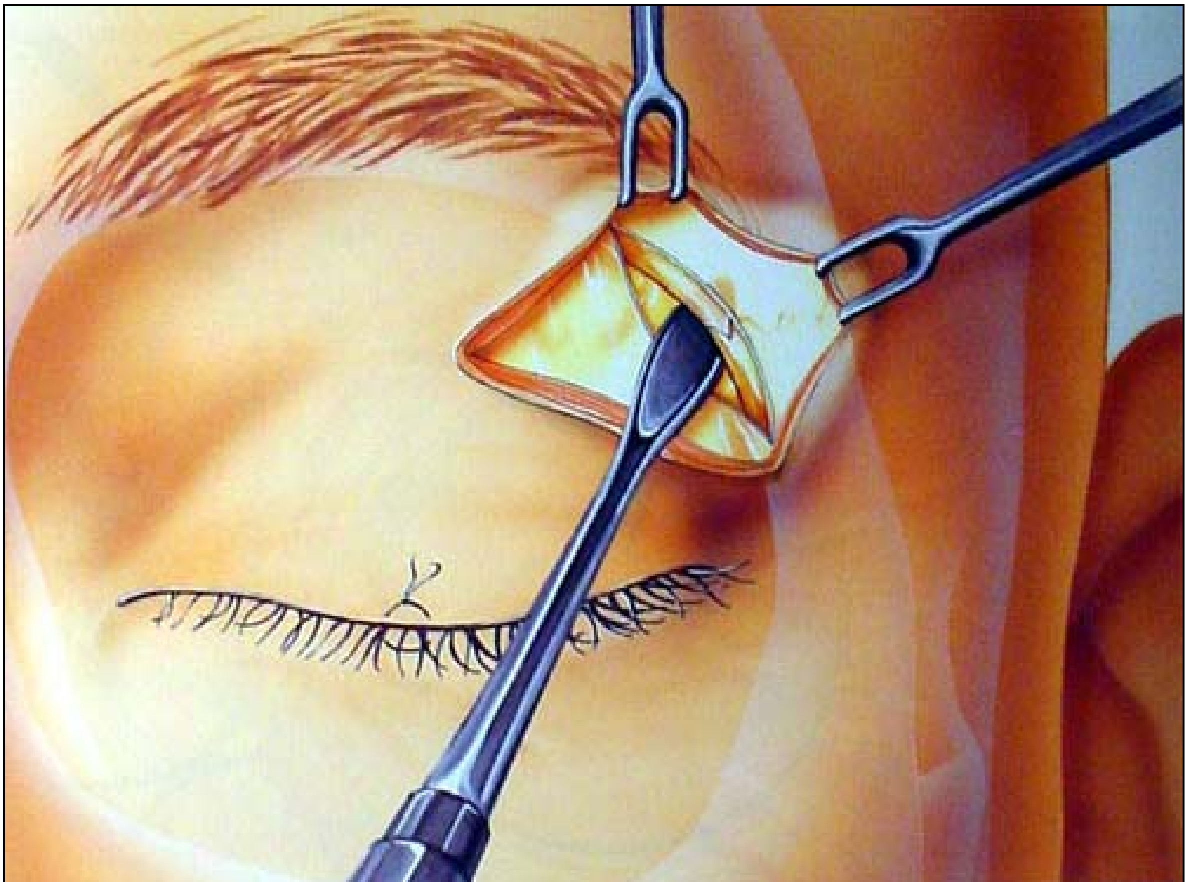


Figure 5 4 Incision through periosteum along lateral orbital rim and subperiosteal dissection into lacrimal fossa. To facilitate retraction of the skin/muscle flap, it can be widely undermined laterally and retracted with small retractors. Because of the concavity just behind the orbital rim in this area, the periosteal elevator is oriented laterally as dissection proceeds posteriorly.

Step 7. Subperiosteal Dissection of Lateral Orbital Rim and Lateral Orbit

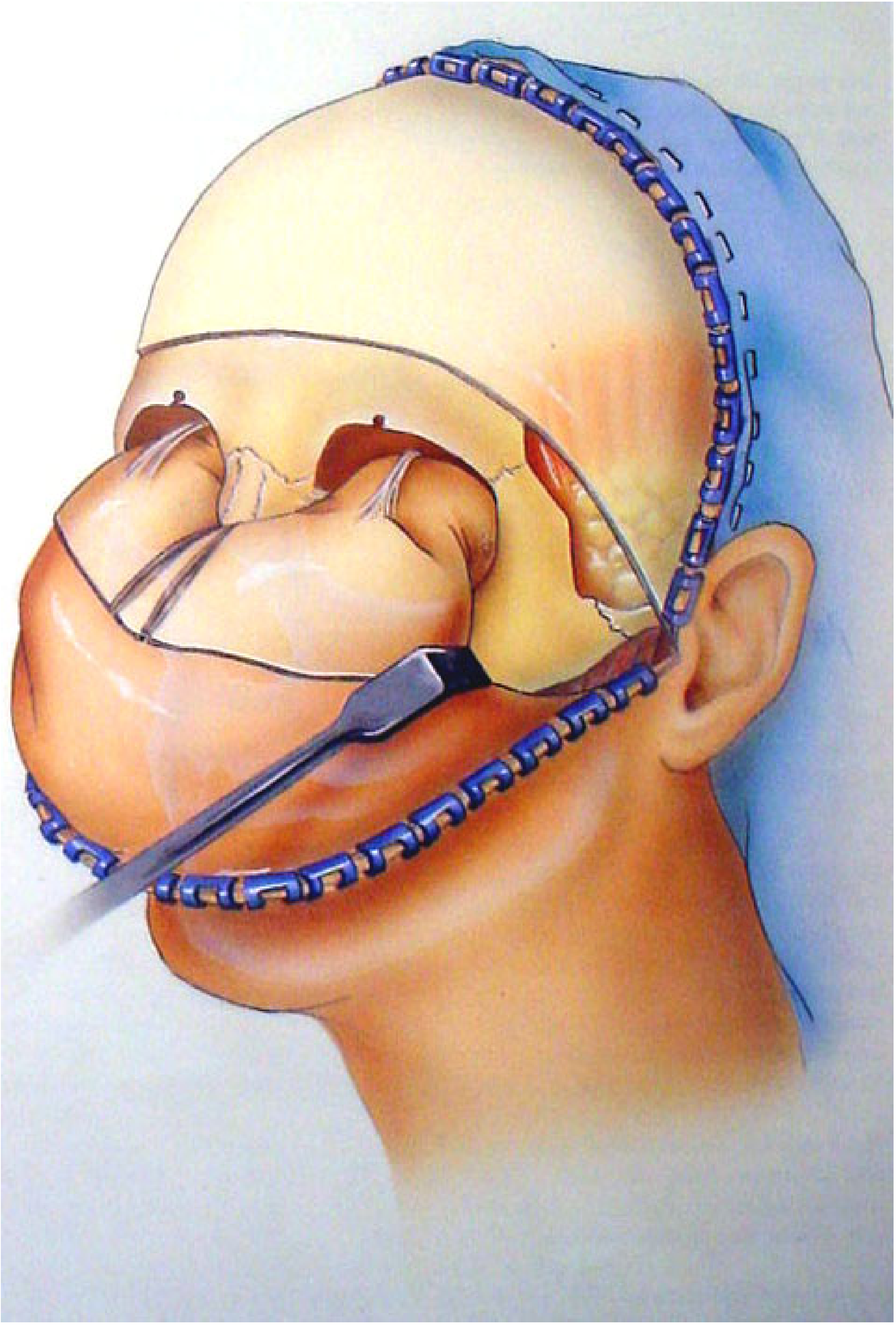
Periosteal elevators are used to perform subperiosteal dissection of the orbit and orbital rims (Fig. 5-4). One must be cognizant of the lacrimal fossa, a deep concavity in the superolateral orbit. When reflecting periosteum from the lateral orbital rim into the orbit, one must turn the periosteal elevator so that it extends almost directly laterally inside the orbital rim. If the periostem is violated, the lacrimal gland will herniate through the periosteum into the surgical field.

Step 8. Closure

The wound is closed in two layers, periosteum and skin/muscle.

SECTION

III CORONAL APPROACH



6 Coronal Approach

The coronal or bi-temporal incision is a versatile surgical approach to the upper and middle regions of the facial skeleton, including the zygomatic arch. It provides excellent access to these areas with minimal complications (1). A major advantage is that most of the surgical scar is hidden within the hairline. When the incision is extended into the preauricular area, the surgical scar is inconspicuous.

SURGICAL ANATOMY

Layers if the Scalp

The basic mnemonic for the layers of the scalp (Fig. 6-1) is :

S = skin
C = subcutaneous tissue
A = aponeurosis and muscle
L = loose areolar tissue
P = pericranium (periosteum)

The skin and subcutaneous tissue of the scalp are surgically inseparable, unlike these same structures elsewhere in the body. Many hair follicles and sweat glands are found in the fat just beneath the dermis. Also, no easy plane of cleavage exists between the fat and the musculoaponeurotic layer.

The musculoaponeurotic layer, also inappropriately called the galea (which refers to aponeurosis *only*), consists of the paired frontalis (epicranius) and occipitalis muscle, the auricular muscles, plus a broad aponeurosis. The aponeurosis is the true galea and has two portions, an extensive intermediate aponeurosis between the frontalis and occipitalis muscles and a lateral extension into the temporoparietal region known as the temporoparietal fascia. Farther inferiorly, the temporoparietal fascia is continuous with the superficial musculoaponeurotic layer of the face (SMAS). The paired frontalis muscles originate from the galeal aponeurosis and insert into the dermis at the level of the eyebrows. An extension of the galea separates the two quadrilateral frontalis muscle in the middle of the forehead.

The galea is a dense, glistening sheet of fibrous tissue, approximately 0,5 mm thick, stretching between the occipitalis and frontalis muscles. When the galea moves, the skin and fat move with it because of their close attachment. Laterally, the galea (or temporoparietal fascia as it is usually called) becomes less dense, but is still readily dissectable. The superficial temporal artery lies on or in this layer.

The subgaleal fascia is the layer usually referred to as the "loose areolar layer" or the "subaponeurotic plane". This layer cleaves readily, allowing the skin, subcutaneous tissue

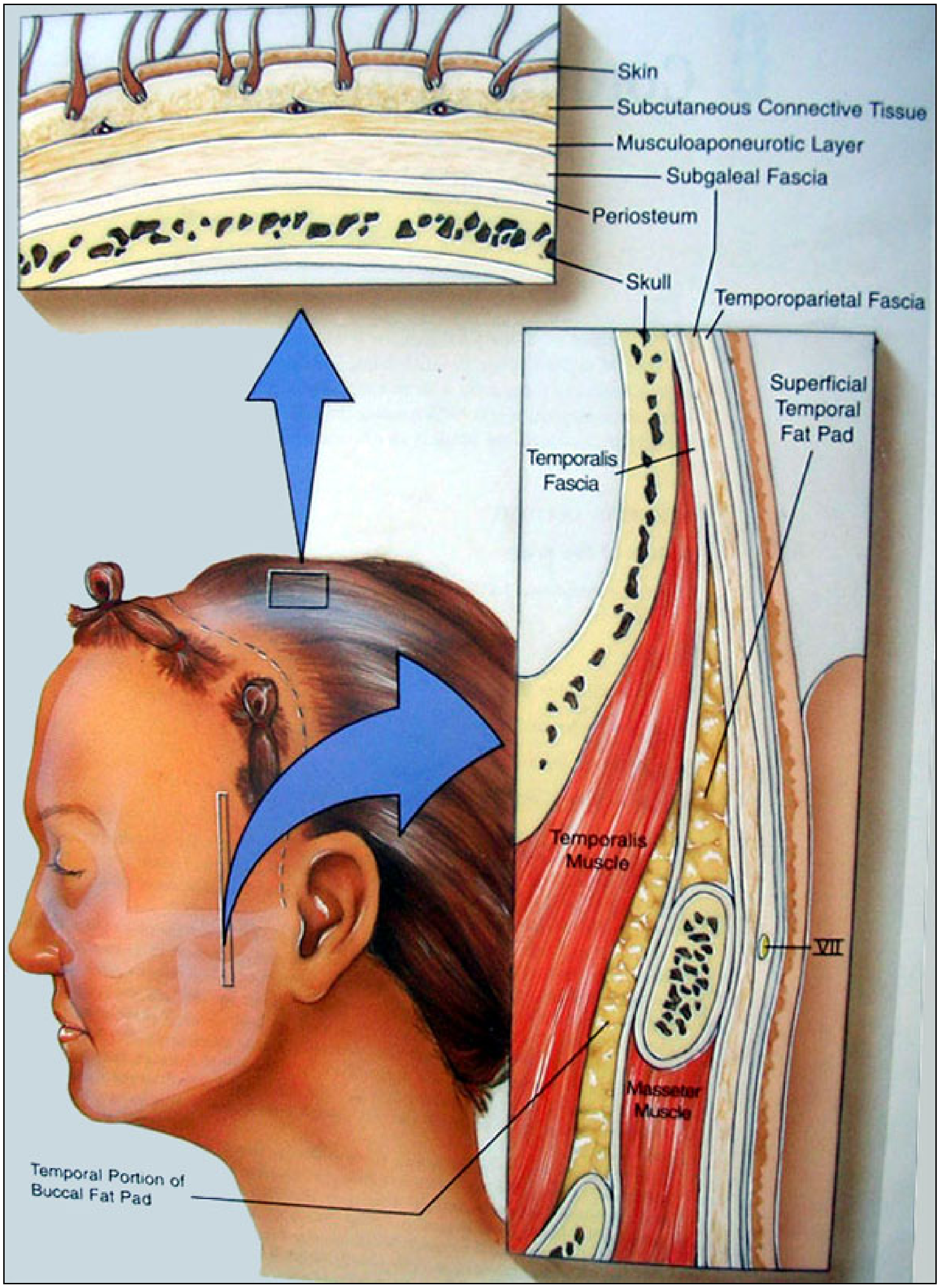


Figure 6 1 Layers of the scalp above the superior temporal line (top insert) and below the superior temporal line (right inset). Top inset : Skin, subcutaneous tissue, the musculoaponeurotic layer (galea in this illustration), the subgaleal layer of loose tissue, periosteum (pericranium), and bone of the skull. Right inset : Skin, subcutaneous tissues, the temporoparietal fascia (note temporal branch of VII N), the superficial layer of the temporalis fascia, a superficial pad of fat, the deep layer of temporalis fascia, the temporalis muscle above, the buccal fat pad below, skull.

musculoaponeurotic layers to be stripped from the pericranium.It is in this fascial plane that cleavage occurs during traumatic avulsion of the scalp. The loose tissue of the subgaleal fascia allows free movement of the skin over the periosteum when the frontalis muscle is contracted. Anatomic dissection have also revealed that the subgaleal frontalis muscle is contracted. Anatomic dissections have also revealed that the subgaleal fascia can be mobilized as an independent fascial layer. For the routine coronal approach to the fascial skeleton, however, this fascial layer is used only for its ease of cleavage.

Anteriorly, the subgaleal fascia is continuous with the loose areolar layer deep to the orbicularis oculi muscles. Laterally, it is attached to the frontal process of the zygoma. This attachment continues along the superior surface of the zygomatic arch, above the external auditory meatus, and over the mastoid process. It terminates by fusing with the periosteum along the superior nuchal line.

The pericranium is the periosteum of the skull. The pericranium can be elevated from the skull, although it is more firmly attached along cranial sutures. When released by subperiosteal dissection, the pericranium retracts owing to its elasticity.

Layers of the Temporoparietal Region (see Fig. 6-1)

The temporoparietal fascia is the most superficial layer beneath the subcutaneous fat. Frequently called the superficial temporal fascia or the zygomatic SMAS, this fascia layer is the lateral extension of the galea and is continuous with the SMAS of the face (Fig. 6-2). Because this fascia is just beneath the skin, it may go unrecognized after incision. The blood vessels of the scalp, such as the superficial temporal vessels, run along its outer aspect, adjacent to the subcutaneous fat. The motor nerves, such as the temporal branch of the facial nerve, run on its deep surface.

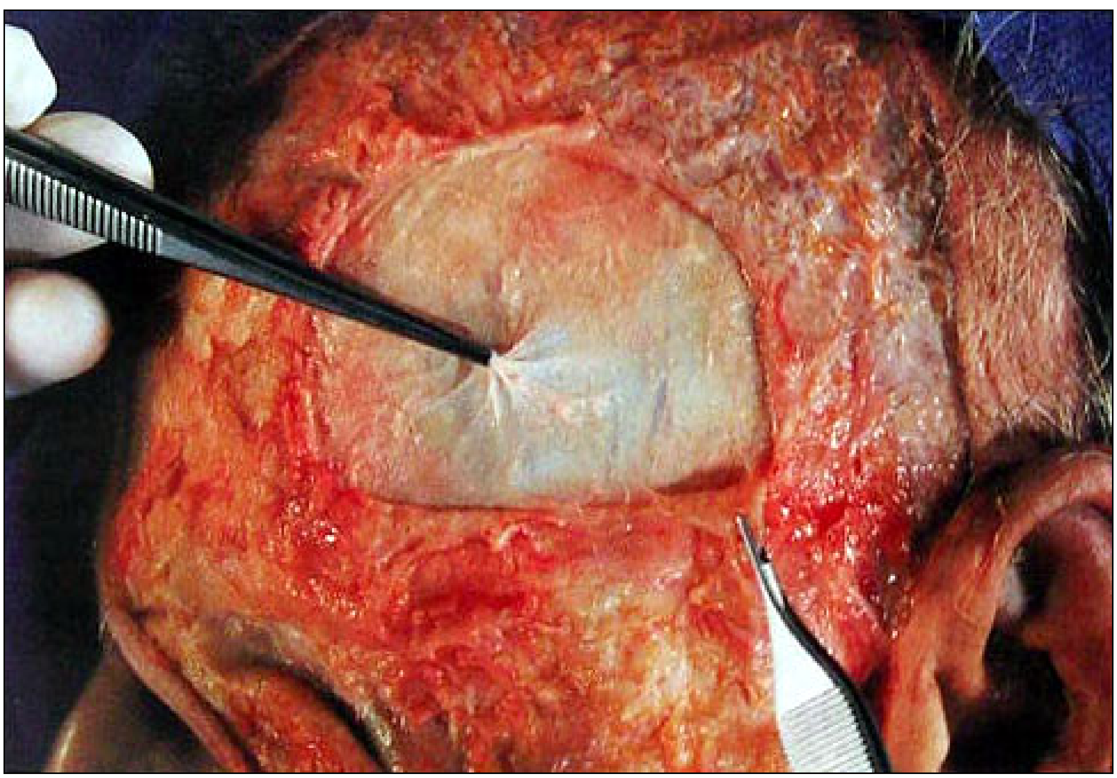


Figure 6 2 Anatomic dissection of the temporal region showing temporoparietal fascia (lower forceps) and subgaleal fascia (upper forceps). Skin and subcutaneous tissues have been removed. Just deep to the subgaleal fascia is the temporalis fascia.

The subgaleal fascia in the temporoparietal region is well developed and can be dissected as a discrete fascial layer, although it is used only as a cleavage plane in the standard coronal approach (see Fig. 6-2).

The temporalis fascia is the fascia of the temporalis muscle. This thick layer arises from the superior temporal line, where it fuses with the pericranium (see Fig. 6-1). The temporalis muscle arises from the deep surface of the temporalis fascia and the whole of the temporal fossa. At the level of the superior orbital rim, the temporalis fascia splints into the superficial layer attaching to the lateral border and the deep layer attaching to the medial border of the zygomatic arch. A small quantity of fat, sometimes called the superficial temporal fat pad, separates the two layers. Dissection through the medial layer of the temporalis fascia reveals another layer of fat, the temporal portion of the buccal fat pad, which is continuous with the other portion of the buccal fat pad of the cheek below the zygomatic arch. This fat pad separates the temporalis muscle from the zygomatic arch and from the other muscles of mastigation, allowing a smooth gliding motion during function.

Temporal Branch of Facial Nerve

The temporal branches of the facial nerve are often called the frontal branches when they reach the supraciliary region. The nerves provide motor innervation to the frontalis, the corrugator, the procerus, and, occasionally, a portion of the orbicularis oculi muscles. Nerve injury is revealed by inability to raise the eyebrow or wrinkle the forehead.

The temporal branch or branches of the facial nerve leave the parotid gland immediately inferior to the zygomatic arch (Fig. 6-3). The general course is from a point 0,5 cm below the tragus to a point 1,5 cm above the lateral eyebrow (2). It crosses superficial to the zygomatic arch an average of 2 cm anterior to the anterior concavity of the external auditory canal, but in some cases, it is as near as 0,8 cm and as far as 3.5 cm anterior to the external auditory canal (Fig. 6-4) (3). As it crosses the lateral surface of the arch, the temporal branch courses along the undersurface of the temporoparietal fascia, and subgaleal fascia (see Fig. 6-1). As the nerve courses anterosuperiorly toward the frontalis muscle, it lies on the undersurface of the temporoparietal fascia (Fig. 6-5), and

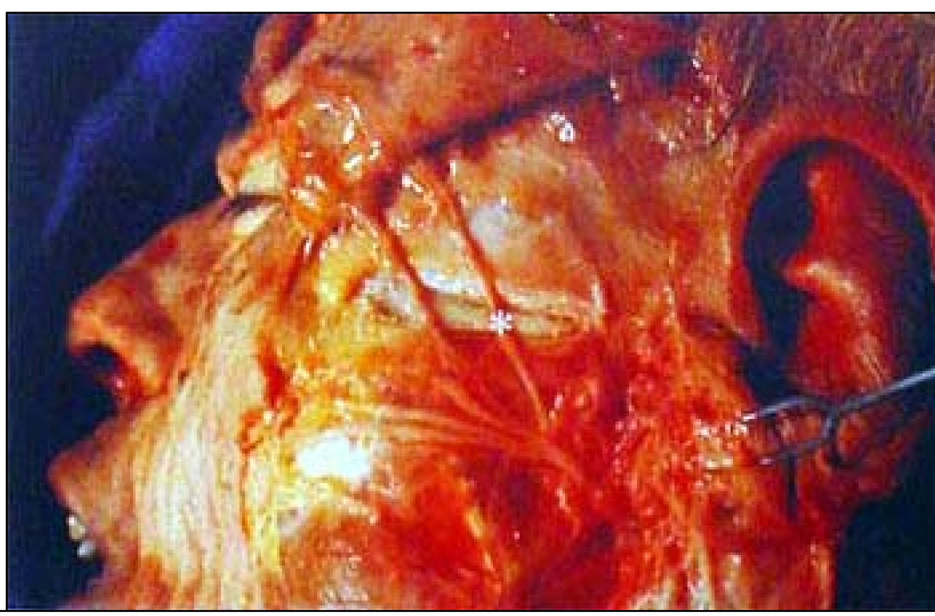
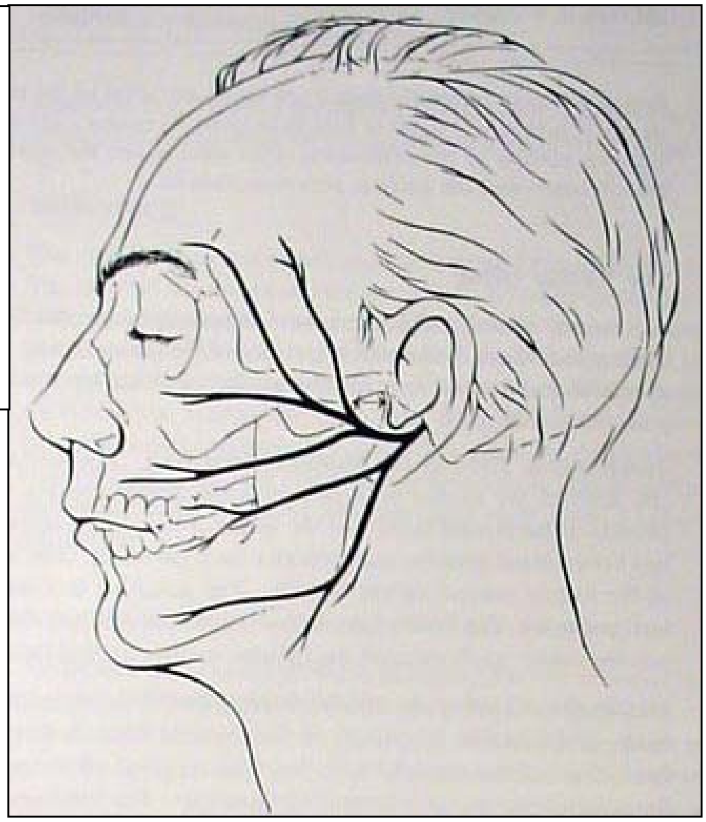


Figure 6- 3 Anatomic dissection showing branches of the facial nerve. Note the relationship of the temporal branch to the zygomatic arch (*). In this specimen, the branch crosses just anterior to the articular eminence of the temporomandibular joint.

Figure 6-4 Branches of the facial nerve. The distance from the anterior concavity of the external auditory canal to the crossing of the zygomatic arch (arrow) by the temporal branch varies from 8 to 35 mm.



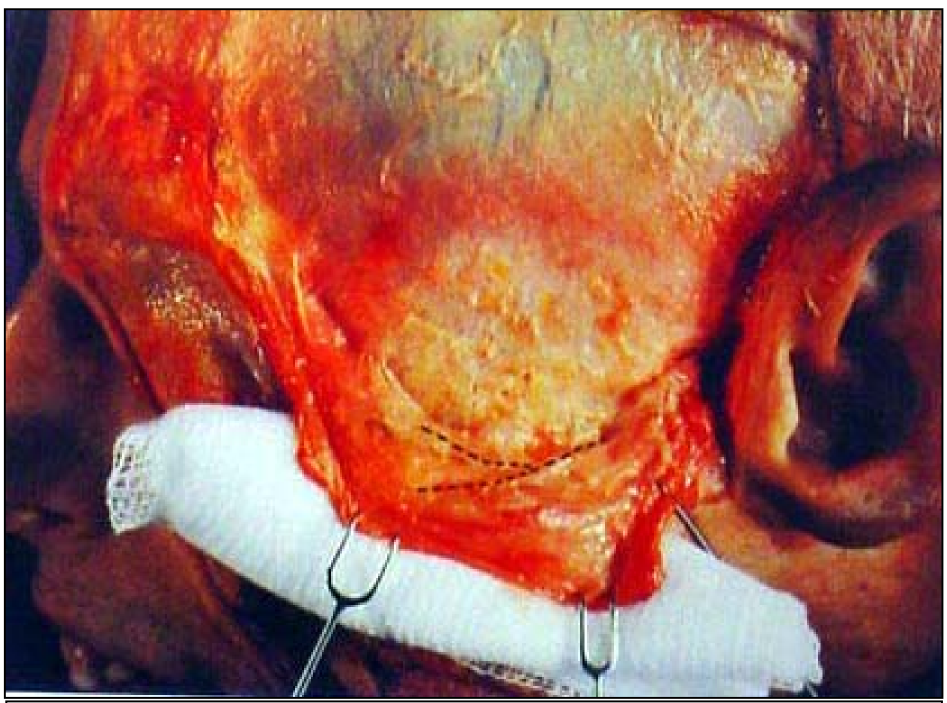


Figure 6- 5 Anatomic dissection showing position of the temporal branch of the facial nerve in relation to the temporoparietal fascia and zygomatic arch. The temporoparietal fascia is retracted inferiorly. The temporal branch of the facial nerve courses on its deep surface (or within the layer of fascia) anteriorly and superiorly (dashed lines), between the temporoparietal fascia and the fusion of the superficial layer of the temporalis fascia with the periosteum of the zygomatic arch.

enters the frontalis muscle no more inferiorly than 2 cm above the level of the superior orbital rim. It commonly branches into three or four rami long its course. The anterior branches supply the superior portion of the orbicularis oculi muscle and the frontalis muscle. The posterior branch innervates the anterior auricular muscles.

The medial Orbit

The medial orbital wall is composed of several bones: the frontal process of the maxilla, the lacrimal bone, the lamina papyracea of the ethmoid, and part of the lesser wing of the sphenoid. In terms of function, the medial orbit can be divided into anterior, middle, and posterior thirds.

Anterior One Third of the Medial Orbital Wall. The medial orbital rim and the anterior one third of the medial orbit comprise the frontal process of the maxilla, the maxillary process of the frontal bone, and the lacrimal bone. The lacrimal fossa for the lacrimal sac lies between the anterior and posterior lacrimal crest. The anterior crest is a continuation of the frontal process of the maxilla. The posterior lacrimal crest is an extension of the lacrimal bone. The bone of the lateral nasal wall contains the nasolacrimal duct, which enters the nasal cavity through the inferior meatus located beneath the inferior turbinate.

Middle One Third of the Medial Orbital Wall This part of the medial orbital wall, largely made of the lamina papyracea of the ethmoid bone, is thin, but is reinforced by the buttress effect of the ethmoid air cells. The only vascular structures of any significance are the anterior and the posterior ethmoidal arteries. The foramina for the anterior and posterior ethmoid arteries and nerves are found in, or just above, the frontoethmoid suture line at the level of the cribriform plate. The anterior ethmoid foramen is located approximately 24 mm posterior to the anterior lacrimal crest (4) (Fig. 6-6). The posterior ethmoid foramen or foramina (25% are multiple) are located approximately 36 mm posterior to the anterior lacrimal crest (4). The optic canal is located approximately 42 mm posterior to the anterior lacrimal crest. The distance between the posterior ethmoidal artery and the optic nerve is variable, but it is never less than 3 mm (4).

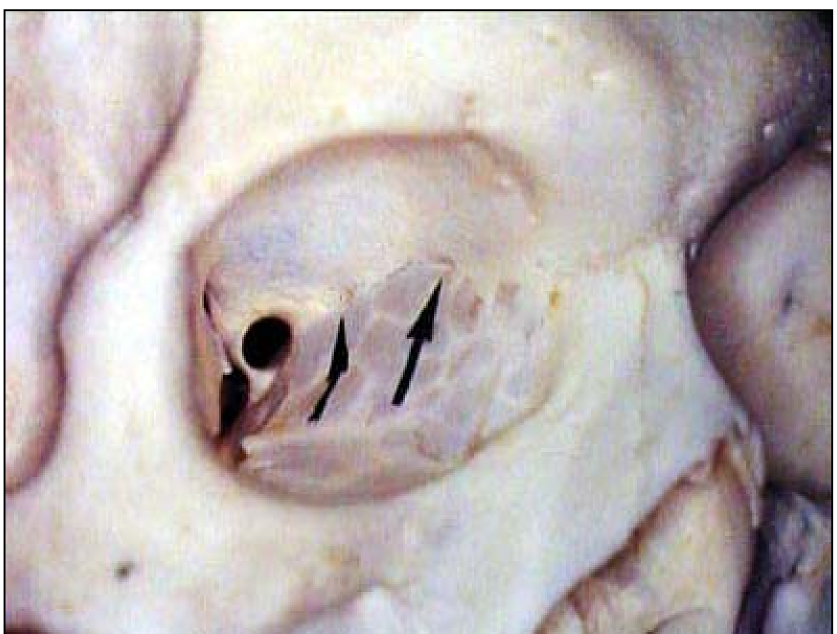


Figure 6- 6 Medial orbital wall of the skull. Note the position of the anterior and posterior ethmoidal foramina (arrows). They are not located at the most superior portion of the orbit but at the level of the cribriform plate.

Posterior One Third of the Medial Orbital Wall. The posterior part of the orbit is made of thick bone surrounding the optic foramen and superior orbital fissure.

TECHNIQUE

The coronal approach can be used to expose different areas of the upper and middle face, The layer of dissection and the amount of exposure depend on the particular surgical procedure for which the coronal approach is used. In some instances, it may be prudent to perform a subperiosteal elevation of the flap from the point of incision. The periosteum is freed with a scalpel along the superior temporal lines as one proceeds anteriorly with the dissection, leaving the temporalis muscle attached to the skull. In most cases, however, dissection and elevation of the flap are in the easily cleaved subgaleal plane. For illustrative purposes, the following description is that of complete exposure of the upper and middle face, including the zygomatic arch, using a subgaleal dissection for most of the flap elevation.

Step 1. Locating the Incision Line and Preparation

Two factors are considered when designing the line of incision. The first is the hairline of the patient. In males, expected recession at the widow's peak as well as male pattern baldness should be contemplated. The incision for balding males might be placed along a line extending from one preauricular area to the other, several centimeters behind the hairline (Fig. 6-7), or even more posteriorly. Incision made farther posteriorly need not reduce access to the operative field, because

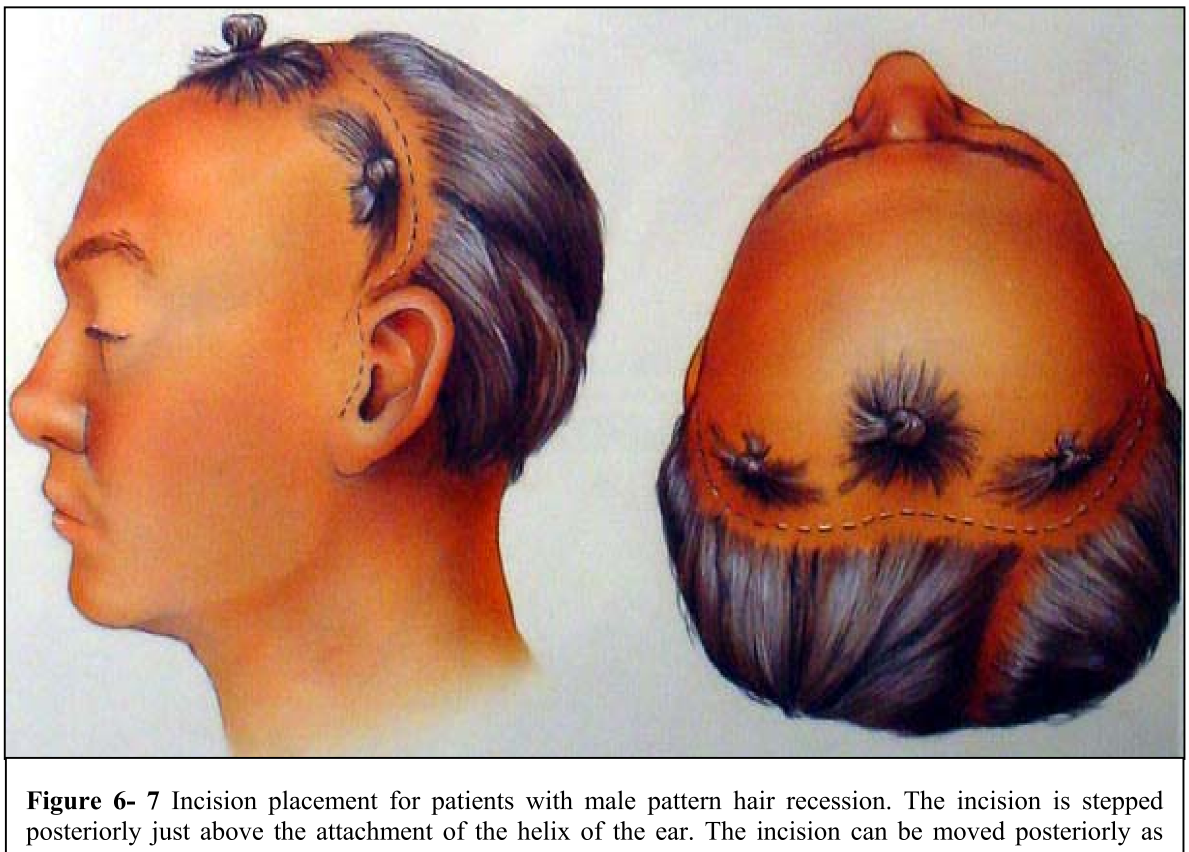


Figure 6- 7 Incision placement for patients with male pattern hair recession. The incision is stepped posteriorly just above the attachment of the helix of the ear. The incision can be moved posteriorly as necessary.

the amount of skeletal exposure depends on the inferior extent of the incision, not on the anteroposterior position. In most females and nonbalding males, the incision may be curved anteriorly at the vertex, paralleling but remaining 4 to 5 cm within the hairline (Fig. 6-8). In children, the incision is preferably placed well behind the hairline to allow for migration of the scar with growth. If a hemicoronal incision is planned, the incision curves forward at the midline, ending just posterior to the hairline. Curving the hemicoronal incision anteriorly provides the relaxation necessary for retraction of the flap.

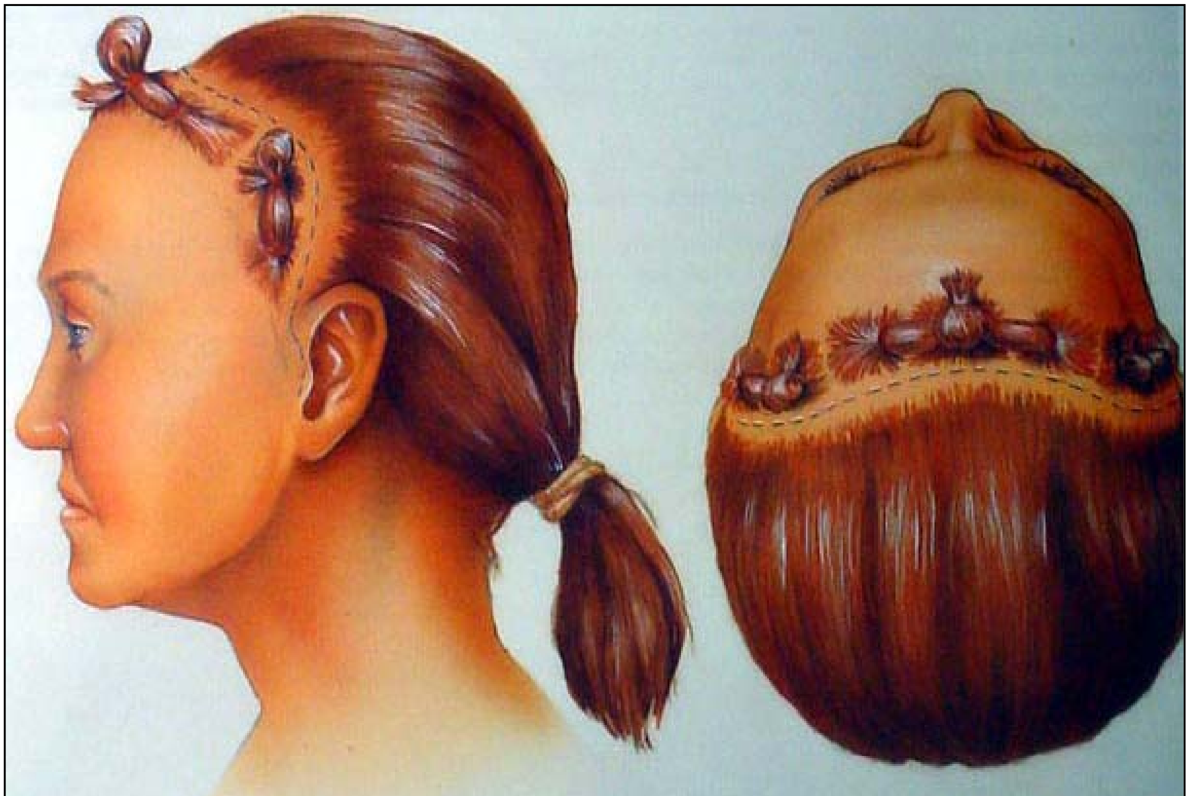


Figure 6- 8 Incision placement for most female patients and males with no signs or family history of baldness. The incision is kept approximately 4 cm behind the hairline.

The second factor considered in designing the location of the incision is the amount of inferior access required for the procedure. When exposure of the zygomatic arch is unnecessary, extension of the coronal incision inferiorly to the level of the helix may be all that is necessary. The coronal incision can extended inferiorly, however, to the level of the lobe of the ear as a preauricular incision. This maneuver allows exposure of the zygomatic arch, temporomandibular joint (TMJ), and/or infraorbital rims.

Extensive shaving of the head before incision is not medically necessary. In fact, direction of the hair shafts may be used as a guide for incision bevel to minimize damage to the follicles. The presence of hair makes closure more difficult, but does not seem to cause an increase in the rate of infection. A comb can be used to separate the hair along the proposed incision line. Long hair can be held in clumps with elastics placed either before or after sterile preparation. This measure minimizes the annoyance of loose hair in the operative field (Fig. 6-9). If shaving the hair is desired, it need not to be extensive - a small strip, approximately 12 to 15 „. Is adequate. The drapes can be sutured or stapled to the scalp approximately 1,5 cm posterior to the planned incision site, covering the posterior scalp and confining this hair.

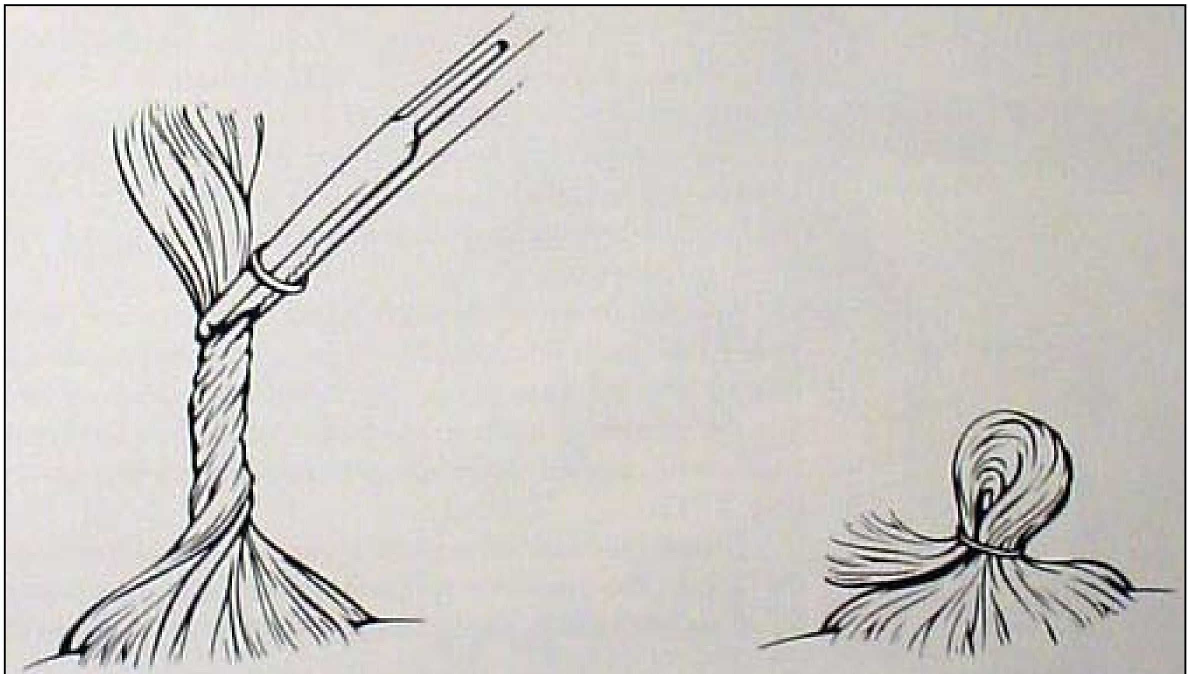


Figure 6- 9 Technique of gathering hair into clumps and securing the clumps with small elastics bands. Small bundles of the hair are twisted with the fingers and each is grasped in the middle with a hemostat loaded with an elastic band. The elastic band is rolled off the hemostat onto the hair bundle below the tips of the hemostat, which can be removed.

Step 3. Incision

Cross hatches or dye markings across the proposed site of incision assist in properly aligning the scalp during closure. The first is made in the midline and subsequent marks are made laterally at approximately equal distances from the midline (Fig. 6-10). Crosshatches made with a scalpel tip should be deep enough (until bleeding) so that their location is visible at the end of the surgical procedure.

The initial portion of the incision is made with a no. 10 blade or special diathermy knife, extending from one superior temporal line to the other. For routine coronal exposure, the incision is made through skin, subcutaneous tissue, and galea (see Fig. 6-10), revealing the subgaleal plane of loose areolar connective tissue overlying the pericranium. The flap margin may be rapidly and easily lifted and dissected above the pericranium. Limiting the initial incision through the temporalis fascia into the temporalis musculature, which bleeds freely.

The skin incision below the superior temporal line should be to the depth of the glistening superficial layer of temporalis fascia. This depth is into the subgaleal plane, continuous with the dissection above the superior temporal line. An easy method to ensure that the incision is made to the proper depth is to bluntly dissect in the subgaleal plane from above, toward the zygomatic arch, with curved scissors and incising to that depth (Fig . 6-11).

Preauricular extension of the incision is within a preauricular skin fold to the level of the lobule. The dissection severs the preauricular muscle and follows the cartilaginous external auditory canal, similar to the dissection described in Chapter 12.

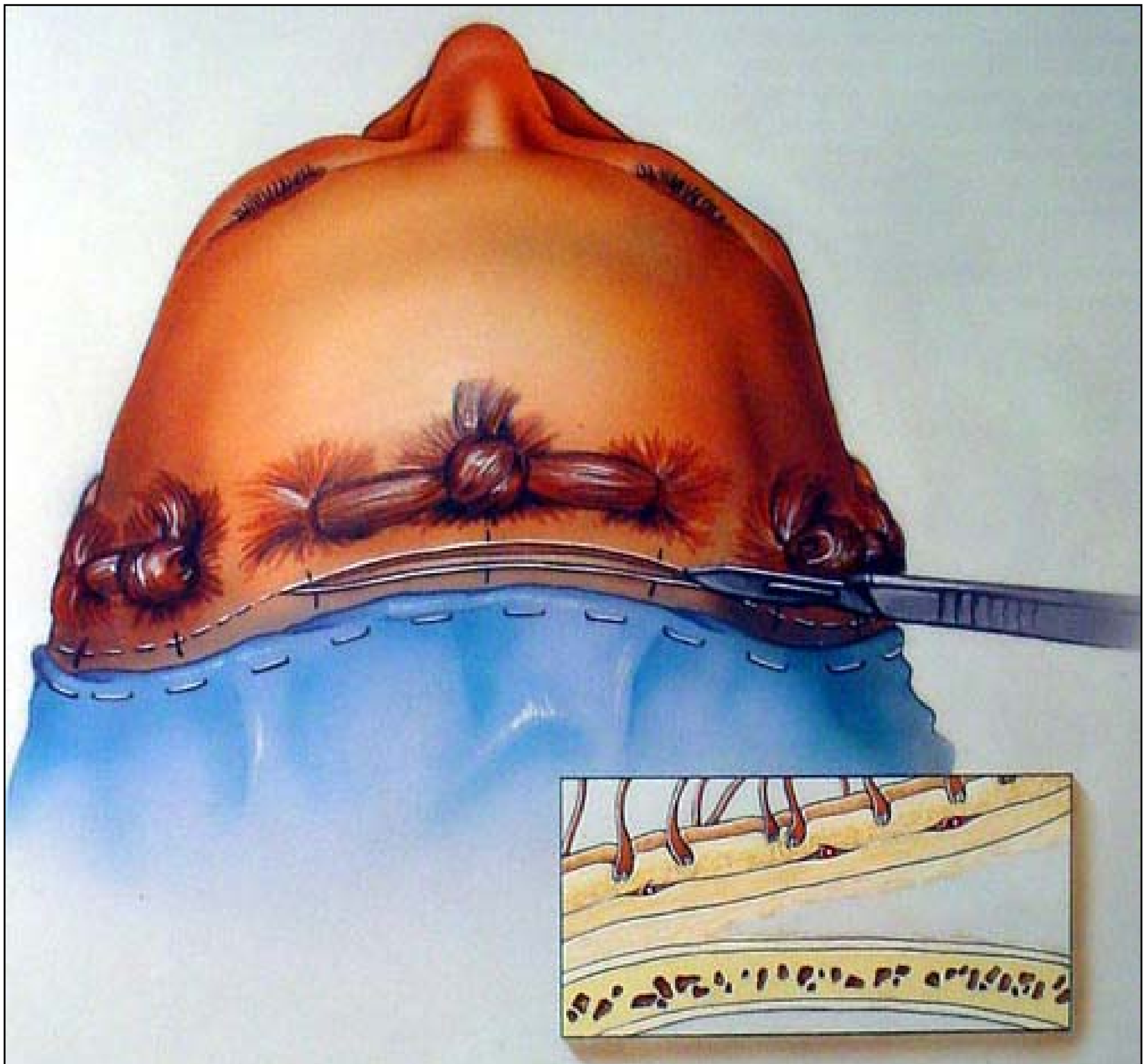


Figure 6- 10 Draping of the patient and the initial incision. The drapes are secured with staples and/or sutures just posterior to the location of the planned incision. Cross-hatches are scored into the scalp at several locations for realignment of the flap during closure. The initial incision extends from one superior temporal line to the other, to the depth of the pericranium (see inset). The dissection will be in the subgaleal plane, which is loose connective tissue and cleaves readily.

Figure 6- 2 11 One technique for incising the scalp in the temporal region. Scissor dissection of the scalp in the subgaleal plane can proceed inferiorly from the previous incision made above the superior temporal line. While the scissors are spread, a scalpel incises to them, preventing the surgeon from incising the temporalis fascia and the muscle, which bleeds freely.

Step 4. Elevation of the Coronal Flap and Exposure of the Zygomatic Arch

After elevation of the anterior and posterior wound margins for 1 to 2 cm, hemostatic clips (Raney clips) are applied or bleeding vessels are isolated and cauterized. Indiscriminate cauterization of the edge of the incised scalp can result in areas of alopecia and should be avoided. A technique to expedite clip removal before closure involves positioning an unfolded gauze sponge the cut edge of the scalp before clip application. The gauze can be pulled off the scalp before closure, removing the accompanying row of clips. In some instances, bleeding encountered during the procedures is from small emissary veins exiting through the pericranium or exposed skull. Cauterization, bone wax, or both are useful for these vessels.

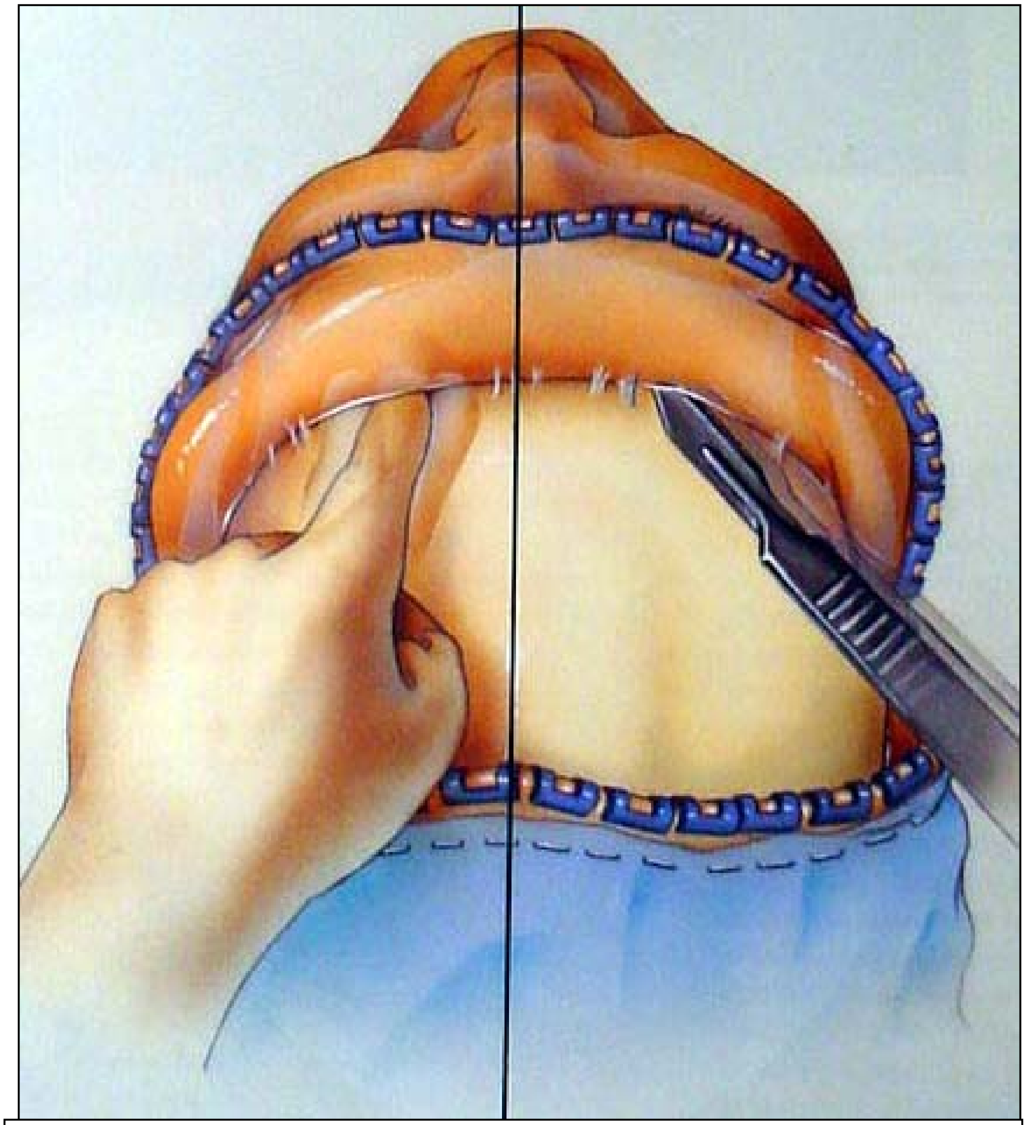


Figure 6- 12 Two methods of dissecting the flap in the subgaleal plane. Left, finger dissection readily cleaves the areolar tissue in the subgaleal plane. Several centimeters above the orbital rims, however, the pericranium is more tightly bound to the frontalis muscle and the periosteum may strip from the bone when using this technique in this location. Right, dissection with a scalpel. The flap is lifted gently with retractors and/or hooks to maintain gentle tension. The back (dull) edge of the scalpel rests on the pericranium and is swept back and forth, allowing the point of the scalpel to incise the subgaleal tissue. This technique is especially useful in flaps elevated for a second or third time, where adhesion in the subgaleal layer are more common and must be sharply incised.

The flap may be elevated atop the pericranium with finger dissection, with blunt periosteal elevators, or by back-cutting with scalpel (Fig. 6-12). As dissection proceeds anteriorly tension develops because the flap is still attached laterally over the temporalis muscles. Dissecting that portion of the flap below the superior temporal line from the temporalis fascia relieves this tension and allows the flap to retract farther anteriorly. Along the lateral aspect of the skull, the glistering white temporalis fascia becomes visible where it blends with the pericranium at the superior temporal line. The plane of dissection is just superficial to this thick fascial sheet.

Dissection of the flap continues anteriorly in the subgaleal fascial plane to a point 3 to 4 cm superior to the supraorbital rims. A finger is used to palpate and locate the superior temporal lines, and a horizontal incision is made through pericranium from one superior temporal line to the other (Fig. 6-13). The surgeon should not extend the incision beyond the superior temporal line or the temporalis muscle will be cut and begin to bleed. A subperiosteal dissection then continues to the supraorbital rims.

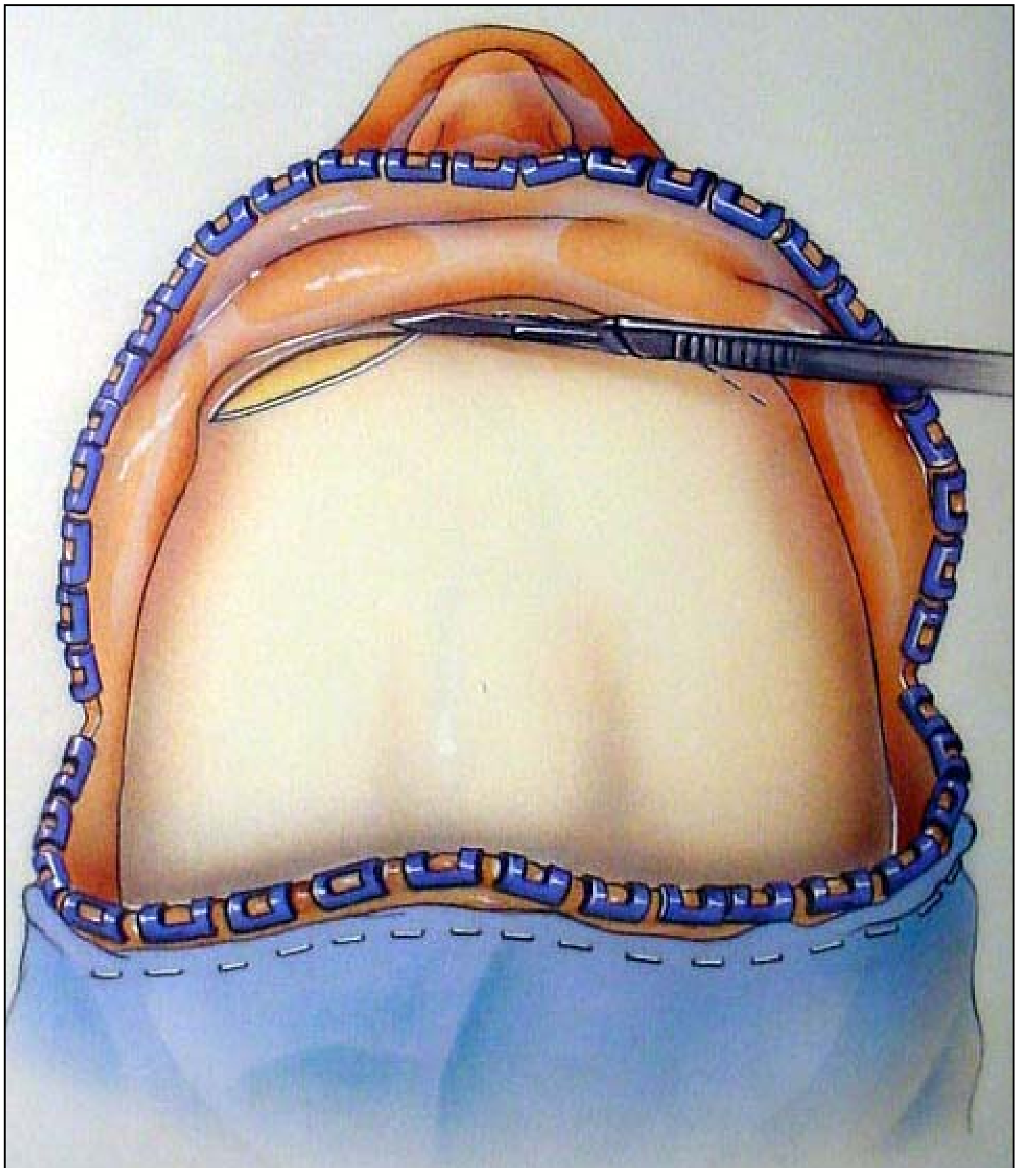


Figure 6-13 Incision of periosteum across the forehead from one superior temporal line to the other. The tension through periosteum should be 3 to 4 cm superior to the orbital rims.

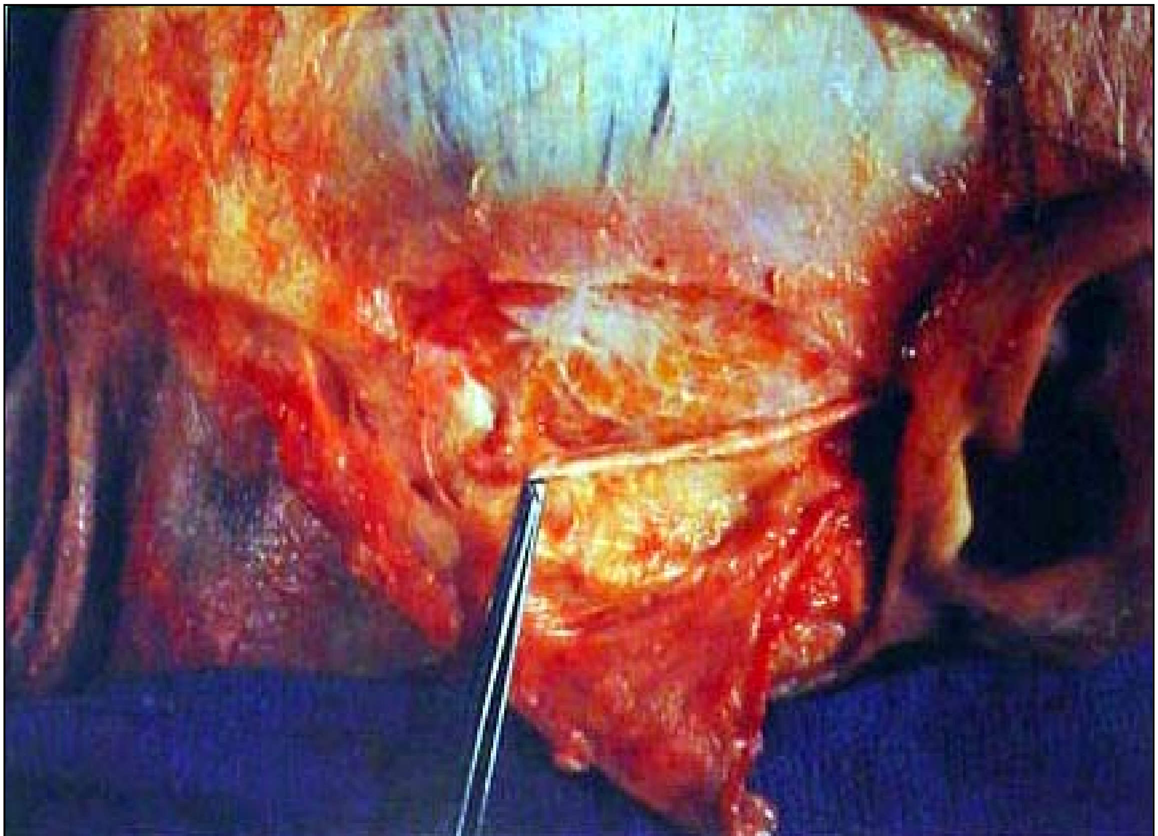


Figure 6 -14 Anatomic dissection showing incision through the superficial layer of temporalis fascia (forceps) several centimeters above the zygomatic arch. Note the underlying fat between this layer of fascia and the deep layer of temporalis fascia. The tempoparietal fascia with the temporal branch of the facial nerve is folded inferiorly (below).

The lateral portion of the flaps is dissected inferiorly atop the temporalis fascia. Once the lateral portion of the flap has been elevated to within 3 to 4 cm of the body of the zygoma and zygomatic arch, these structures usually can be palpated through the covering fascia. Near the ear, the flap is dissected inferiorly to the root of the zygomatic arch. The *superficial layer of temporalis fascia* is incised at the root of the zygomatic arch, just in front of the ear, and continues anteriorly and superiorly at a 45^o angle, joining the cross-forehead incision previous made through pericranium at the superior temporal line. Incision of the superficial layer of temporalis fascia reveals fat and areolar tissue (Fig. 6-14). Further dissection inferiorly within this layer provides a safe route of access to the zygomatic arch, because the temporal branch of the facial nerve is always lateral to the superficial layer of temporalis fascia (Fig. 6-15). Metzenbaun scissors are used to bluntly dissect just under the superficial layer of temporalis fascia, within the space containing the superficial temporal fat pad (see Fig 6-15). Once the superior surface of the zygomatic arch and posterior border of the body of the zygoma are palpable or visible, an incision through periosteum is made along their superior surface. The incision progresses superiorly along the posterior border of the body of the zygoma and orbital rim, ultimately meeting the cross-forehead horizontal incision through pericranium. Subperiosteal elevation exposes the lateral surfaces of the zygomatic arch, body of the zygoma, and a lateral orbital rim (Fig. 6-16). To allow the flap to fold anteriorly, it may be necessary to continue the preauricular component inferiorly and to dissect the flap from the TMJ capsule.

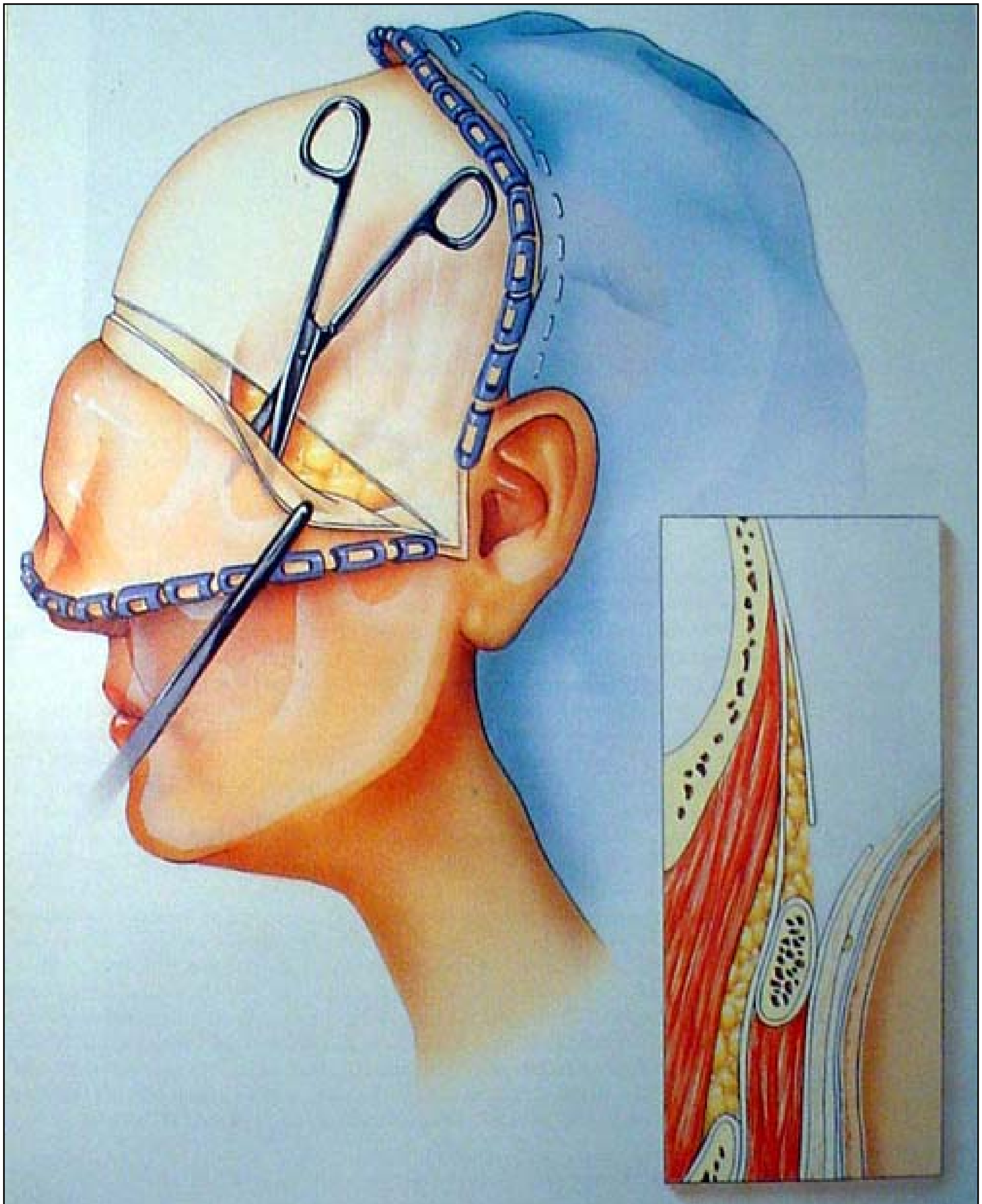


Figure 6-15 Incision made through the superficial layer of the temporalis fascia. Incision begins at the root of the zygomatic arch (above the temporomandibular joint) upward and forward to join the incision made across the forehead in periosteum. One method to approach the posterior portion of the lateral orbital rim and superior surface of the zygomatic arch is also demonstrated. Dissection with incisors is continued deep to the superficial layer of temporalis fascia (see inset), within the superficial temporal fat pad, until bone is encountered. Sharp incision is then made through the periosteum on the superior surface of the zygomatic arch and the posterior surface of the zygoma.

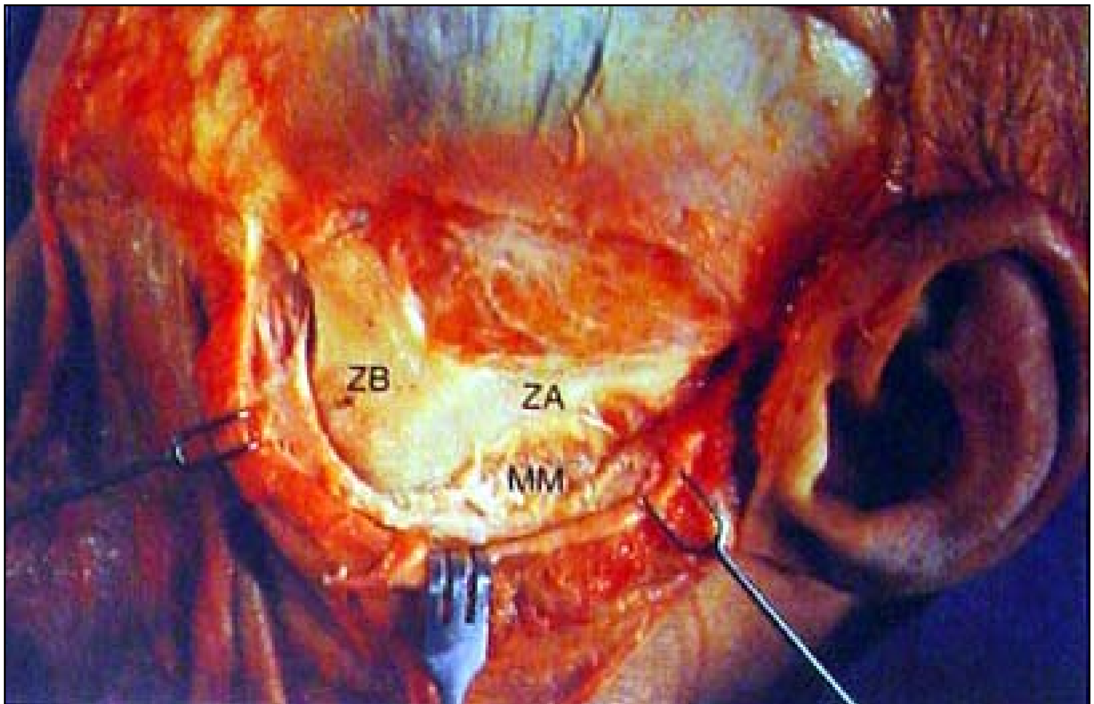


Figure 6-16 Anatomic dissection showing the zygomatic arch (ZA) and body (ZB). The superficial layer of the temporalis fascia and periosteum is retracted inferiorly and anteriorly. Note the masseter muscle (MM) attachment to the inferior portion of the zygomatic arch.

Step 5. Subperiosteal Exposure of the Periorbital Areas

To allow functional access to the superior orbits and/or nasal region, it is necessary to release the supraorbital neurovascular bundle from its notch or foramen. This maneuver involves dissecting in the subperiosteal plane completely around the bundle, including inside the orbit. If no bone is noted inferior to the bundle, the bundle can be gently removed from the bony bridge along the supraorbital rim to release the bundle (Fig. 6-17).

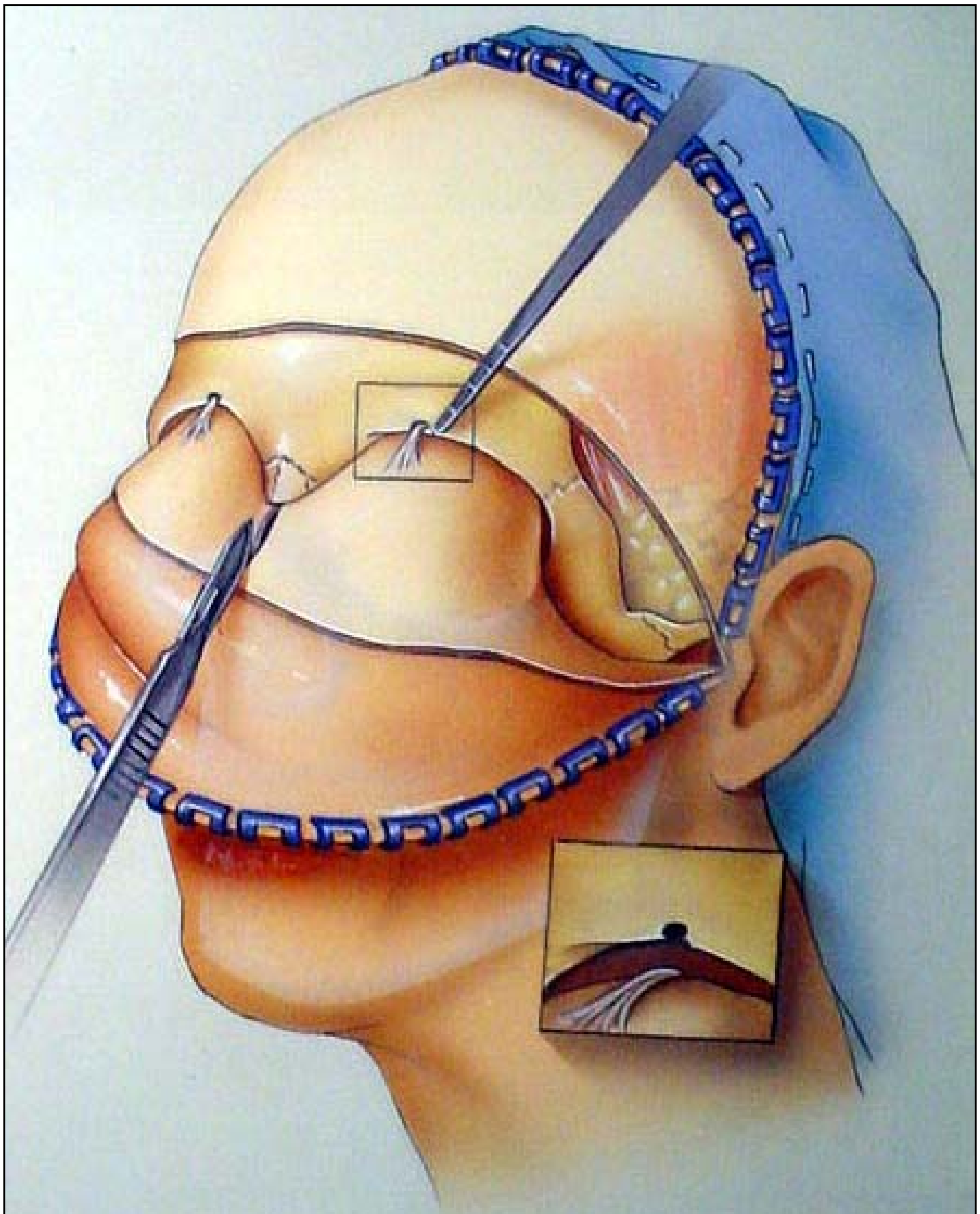


Figure 6-17 Technique of removing bone inferior to the supraorbital foramen (when present) so the neurovascular bundle can be released. Relaxing incisions in the sagital plane through the elevated periosteum over the bridge of the nose are also shown. Use of this technique greatly facilitates dissection more inferiorly along the nasal dorsum.

Further retraction of the flap inferiorly may be accomplished by subperiosteal dissection into the orbits. The orbital contents attached to the lateral orbital tubercle are stripped, allowing dissection deep into the lateral orbit. Release of the periosteum around the inferior rim of the orbit allows exposure of the entire orbital floor and infraorbital region. Access to the infraorbital area is easiest after overlying tissue of the zygomatic arch and body are released to relax the overlying envelope.

Dissection of the periosteum from the superior and medial orbital walls releases the flap and allows retraction down to the level of the junction of the nasal bones and upper lateral cartilages. This technique is facilitated by carefully incising the periosteum of the nasofrontal region (see Fig. 6-17). Dissection can proceed along the dorsum to the nasal tip, if necessary (Fig. 6-18).

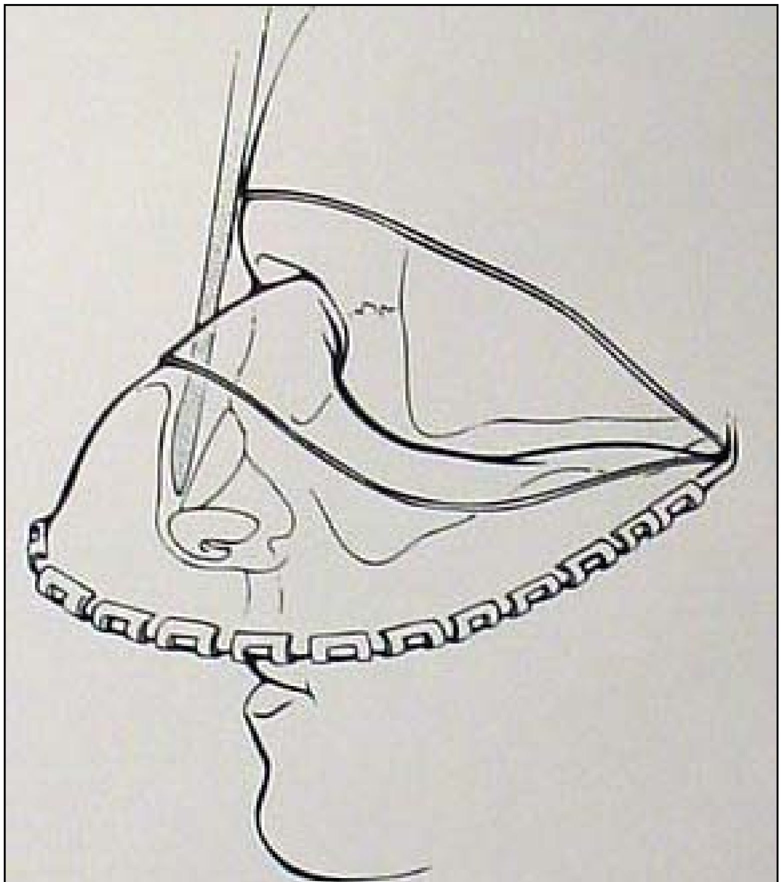


Figure 6-18 Dissection inferiorly to the top of the nose with a periosteal elevator.

The medial canthal tendons should not be inadvertently stripped from their attachments to the posterior and anterior lacrimal crest. They are identified as dense fibrous attachments in the nasolacrimal fossa (Fig. 6-19). The entire medial orbital wall may be exposed without stripping the canthal tendons. As subperiosteal dissection proceeds posteriorly along the medial orbital wall, the surgeon should be on the lookout for the anterior (and posterior) ethmoidal artery. A simple method to identify and cauterize the artery is to strip the periosteum along the roof of the orbit and inferior to where the artery pierces the medial orbital wall. With a periosteal elevator on each side of the foramen, retraction allows the periosteum attached to the foramen to "tent" outward (Fig. 6-20). Bipolar cauterization of the artery may be performed, followed by transection. Dissection can then proceed posteriorly by subperiosteal elevation.

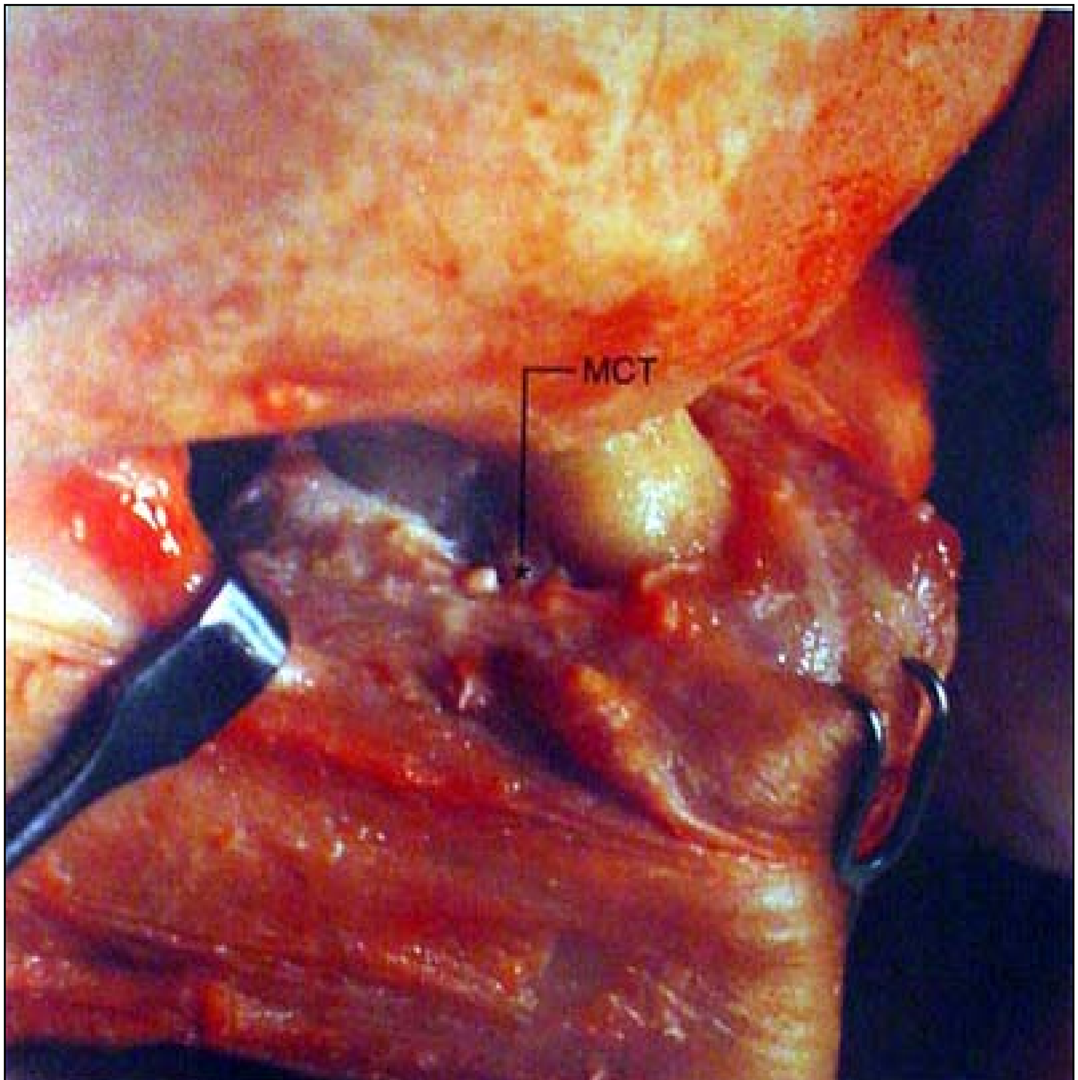


Figure 6-19 Anatomic dissection showing the posterior limb of the medial canthal tendon (MCT) of the right orbit.

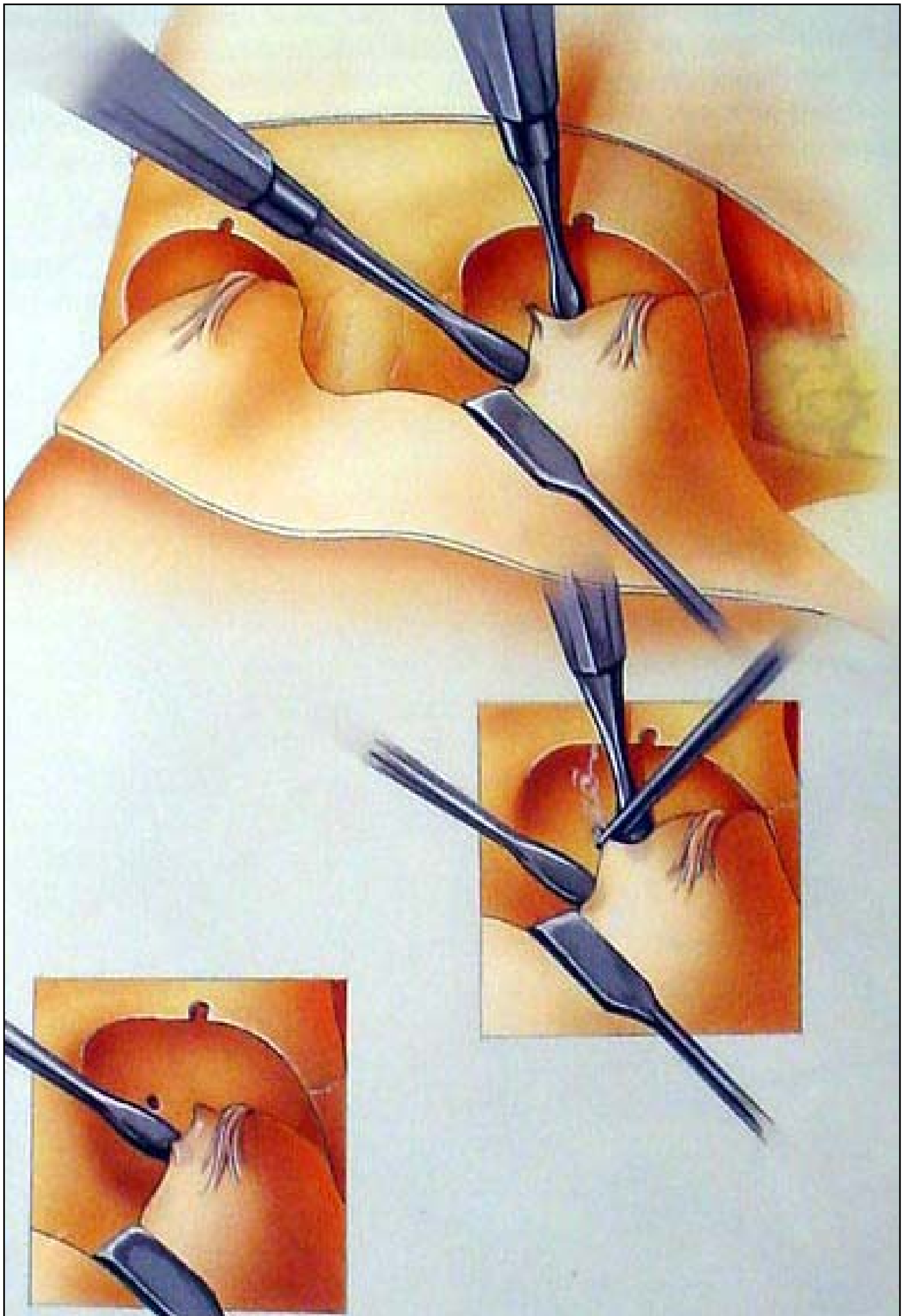


Figure 6-20 Dissection of the medial orbital wall. Periosteal elevators are placed above and below the anterior ethmoidal neurovascular bundle, allowing bipolar cauterization and sectioning.

After the dissections just described, the upper and middle facial regions are completely exposed (Fig. 6-21). The entire orbit can be dissected from the orbital rims to the apex; the only remaining structure is the medial canthal tendon, unless it was intentionally or inadvertently stripped.

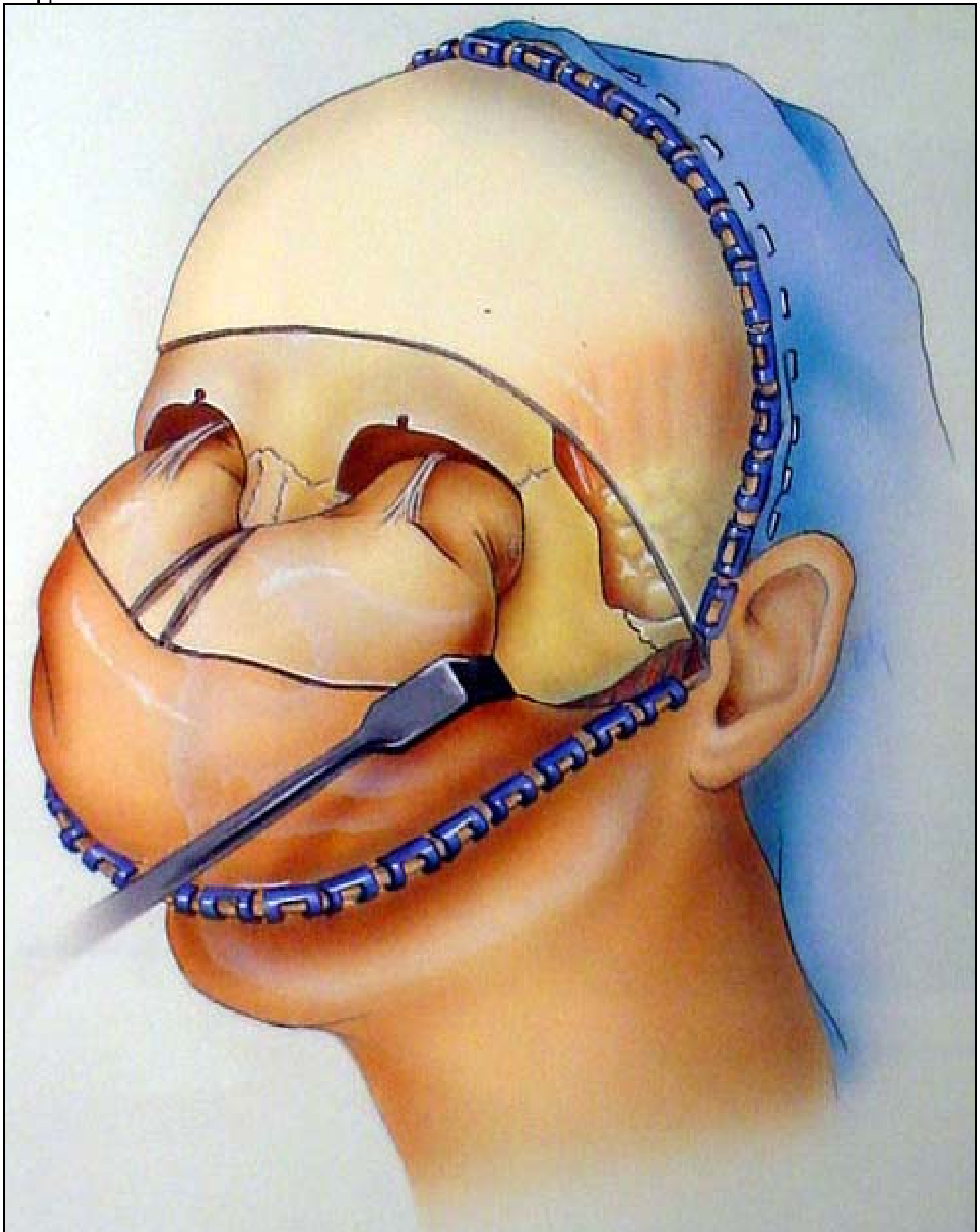


Figure 6-21 Amount of exposure obtained with complete dissection of the upper and middle facial bones using the coronal approach. Note maintenance of attachment of the medial canthal tendon. The infraorbital areas are also exposed if retraction is performed from the side of the orbit.

Step 6. Exposure of the Temporal Fossa

Access into the temporal fossa is possible by stripping the anterior edge of the temporalis muscle from the temporal surfaces of the zygomatic, temporal, and frontal bones. The entire temporalis muscle can be stripped subperiosteally from the temporal fossa if necessary, but care is needed to preserve the blood supply to the temporalis muscle.

Step 7. Exposure of the Temporomandibular Joint and/or Mandibular Condyle/Ramus

Access to the TMJ region may be accomplished by dissection below the zygomatic arch, as described in Chapter 12. Exposure of the lateral surface of the mandibular subcondylar region and ramus may commence lateral to the capsule of TMJ. An incision through the periosteum just inferior to the insertion of the TMJ capsule at the condylar neck will expose the neck of the condyle.

Wider access below the zygomatic arch can be enhanced with two maneuvers. In the first approach, the masseter muscle is cut or released from its origin along the zygomatic arch and body, and then stripped from the lateral surface of the mandibular ramus to expose the ramus of the mandible (Fig. 6-22). The temporalis muscle at the depth of this dissection may be noted at it inserts into the coronoid process. Another approach is to perform an osteotomy of the zygomatic arch, leaving it pedicled to the masseter muscle, and to dissect between the masseter and temporalis muscles, stripping the masseter from the lateral surface of the mandibular ramus. One anatomic consideration is valid with either of these wide exposure methods. The vascular and neural supply to the masseter muscle courses from the medial side of the mandible through the sigmoid notch into the masseter muscle. Therefore, stripping the masseter from above may severely affect its function.

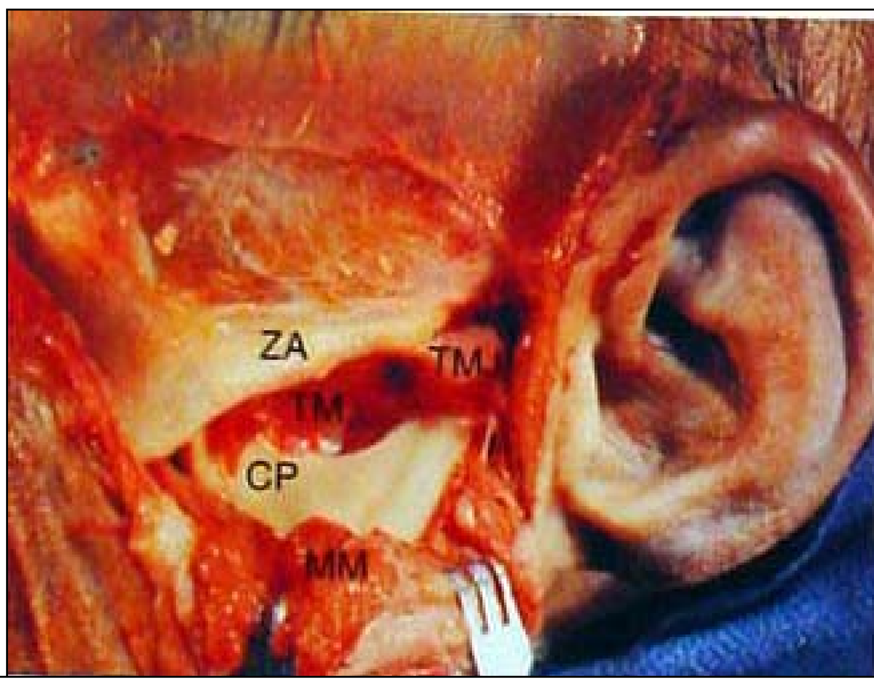


Figure 6-22 Anatomic dissection showing exposure of the superior portion of the mandibular ramus through the coronal approach. In this dissection, the masseter muscle (MM) was stripped from its origin along the undersurface of the zygomatic arch (ZA). The facial nerve is retracted inferiorly and anteriorly. Note the temporomandibular joint (TMJ) capsule, which has not been entered. The temporalis muscle (TM) is still attached to the coronoid process (CP) and the medial surface of the mandible.

Step 8. Harvesting Cranial Bone Grafts

One of the many advantages of the coronal approach is that cranial bone graft harvesting is facilitated. An incision through the periosteum allows exposure for harvesting a bone graft (Fig. 6-23). Closure of the periosteum proceeds scalp closure. Alternatively, subperiosteal dissection posteriorly from the point of the original coronal incision also exposes the cranium for harvesting bone grafts.

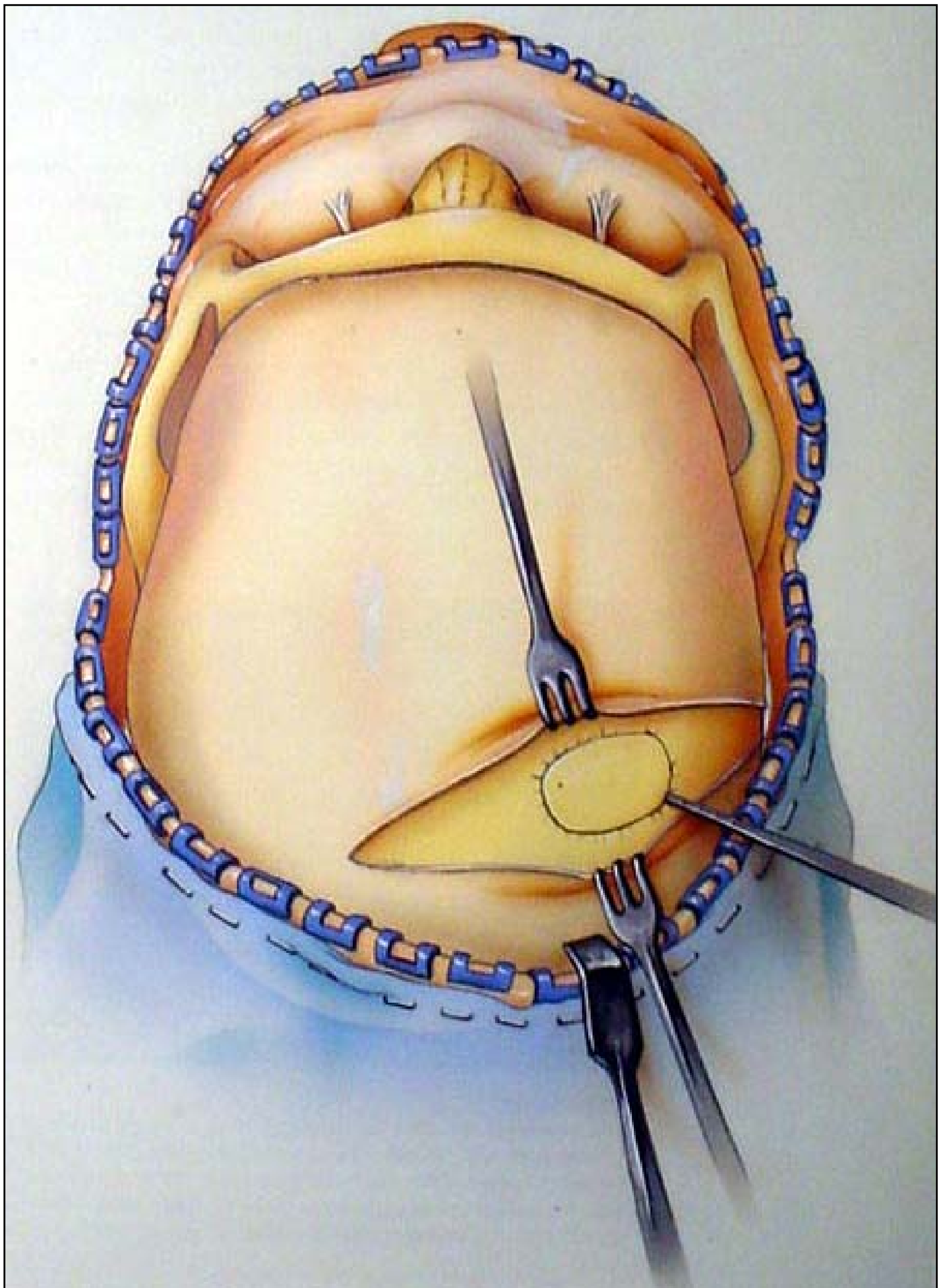


Figure 6-23 Bone graft harvest using the coronal approach.

Step 9. Closure

Closed suction drainage may be employed using a flat drain exiting the hair bearing region of the scalp posterior to the incision. Proper closure of the detached tissues is critical to produce optimal esthetic results. After wide exposure of the malar and infraorbital regions, suture resuspension of the soft tissue is necessary. Slowly resorbing 3-0 sutures are passed through the deep surface of the periosteum of the malar region and then suspended to the temporalis fascia or another stable structure. One or two well-placed sutures are effective to prevent "drooping" of the soft tissues. A lateral canthopexy is also necessary if the attachments to the lateral orbital tubercle were stripped from bone. Toothed forceps are used to identify the superficial portion of the lateral canthal tendon within the deep surface of the coronal flap. One slowly resorbing or permanent 3-0 suture is placed through the lateral canthus from the deep surface of the coronal flap. Location of the proper vertical position of the canthal tendon can be determined by drawing the suture upward or downward while observing the configuration of the palpebral fissure. Ideally, lateral canthopexy of the deep portion of the lateral canthal tendon is performed by drilling a large hole through the lateral orbital rim just below the frontozygomatic suture. The suture and tendon are pulled into this hole. In many instances, however, canthopexy may be accomplished by passing the suture through the anterior portion of the lateral canthal tendon, around the front of the lateral orbital rim, and securing it to a bone screw, a hole in the bone, or the temporalis fascia.

Whenever the temporalis muscle is stripped from the temporal surface of the orbit, it should also be suspended to prevent a hollow appearance in the temporal region. An easy method involves drilling holes through the posterior edge of the orbital rim and suturing the anterior edge of the temporalis muscle with slowly resorbing 3-0 sutures.

Closure of the periosteum around the lateral orbital rim is performed with 4-0 resorbable sutures. Ideally, the periosteum over the zygomatic arch should be closed, but this effort can be difficult owing to the small amount of periosteum available. Suturing the periosteum may also injure the temporal branch of the facial nerve, which is just superficial to the periosteum. Instead, "oversuspension" of the superficial layer of the temporalis fascia is performed. The inferior edge of the superficial layer of the temporalis fascia, which was incised during the approach, is sutured approximately 1 cm superior to the superior edge of the incised fascia (Fig. 6-24). Running horizontal 3-0, slowly resorbing sutures are used for this purpose. Thus, the tissue lateral to the zygomatic arch are suspended tightly in a location that is more superior than it would have been had the incised superficial temporalis fascia simply been sutured.

It is not necessary to close the horizontal periosteal incision across the forehead. The periosteum in this area is thin and does not hold sutures. Closure of the coronal incision will bring the periosteal tissue into acceptable approximation.

The scalp incision is closed in two layers using 2-0 slowly resorbing sutures through the galea/subcutaneous tissues and 2-0 resorbable or permanent skin sutures (smaller sutures are used in children), or staples. As noted previously, use of a suction drain (usually 7 mm flat) is optional. The skin sutures/staples are removed in 7 to 10 days.

The preauricular component of the coronal approach should be closed in layers as for any other preauricular approach.

Pressure dressing are optional, but if used, they should not be tight. Periorbital edema increases greatly with tight pressure dressings on the scalp after coronal approaches.

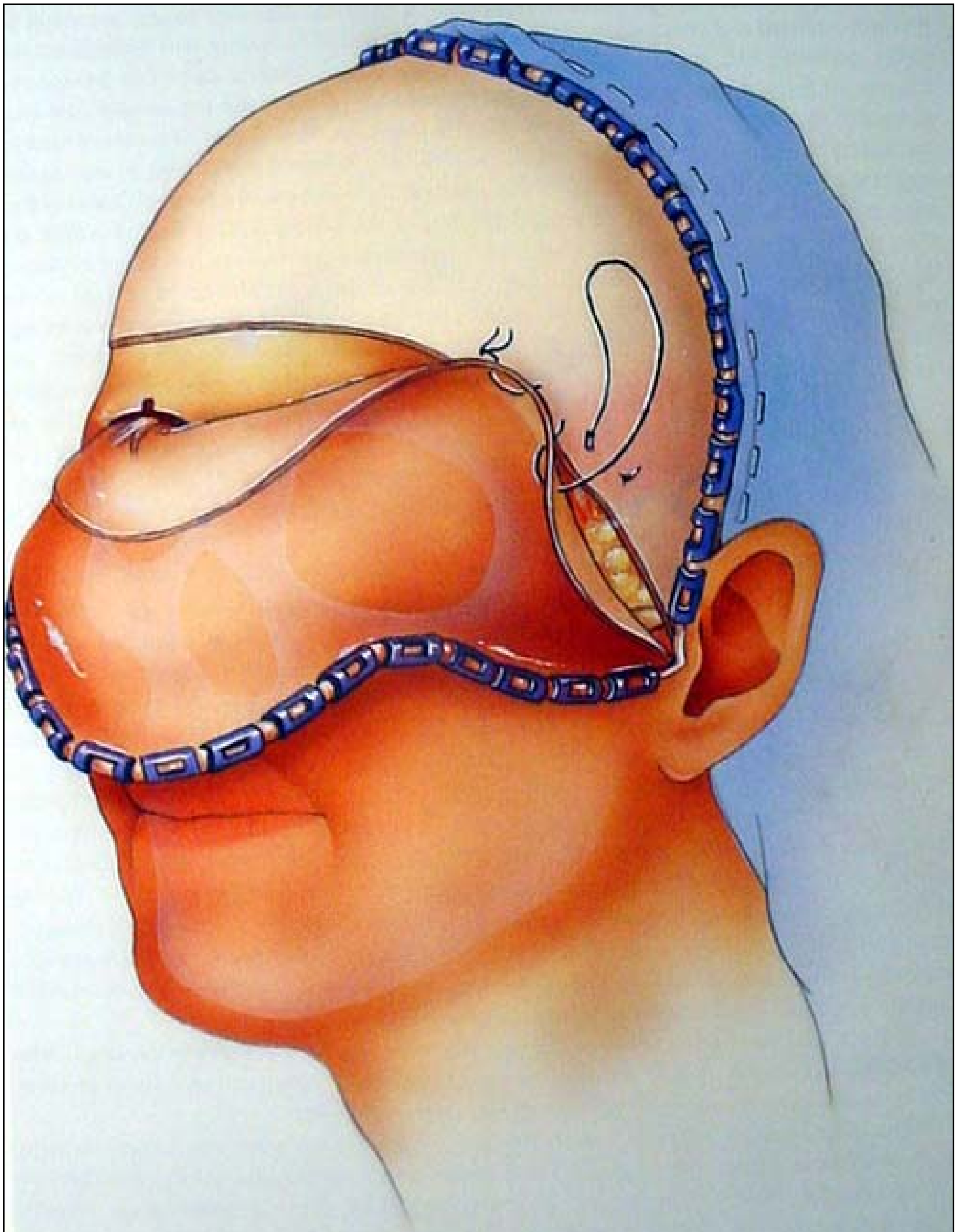


Figure 6-24 Suturing the superficial layer of the temporalis fascia. Note that the inferior edge of fascia is sutured is a more superior location that the cut superior edge.

ALTERNATIVE INCISIONS

The coronal incision has been modified repeatedly by surgeons. The principal difference in these surgical techniques involves the position of the skin incision. A major modification has been placement of the incision behind the ear (Fig. 6-25) (5,6). The advantage of this positioning is further camouflage of the scar. Any inferior extension of the coronal incision can be hidden within the postauricular fold or along the hairline.

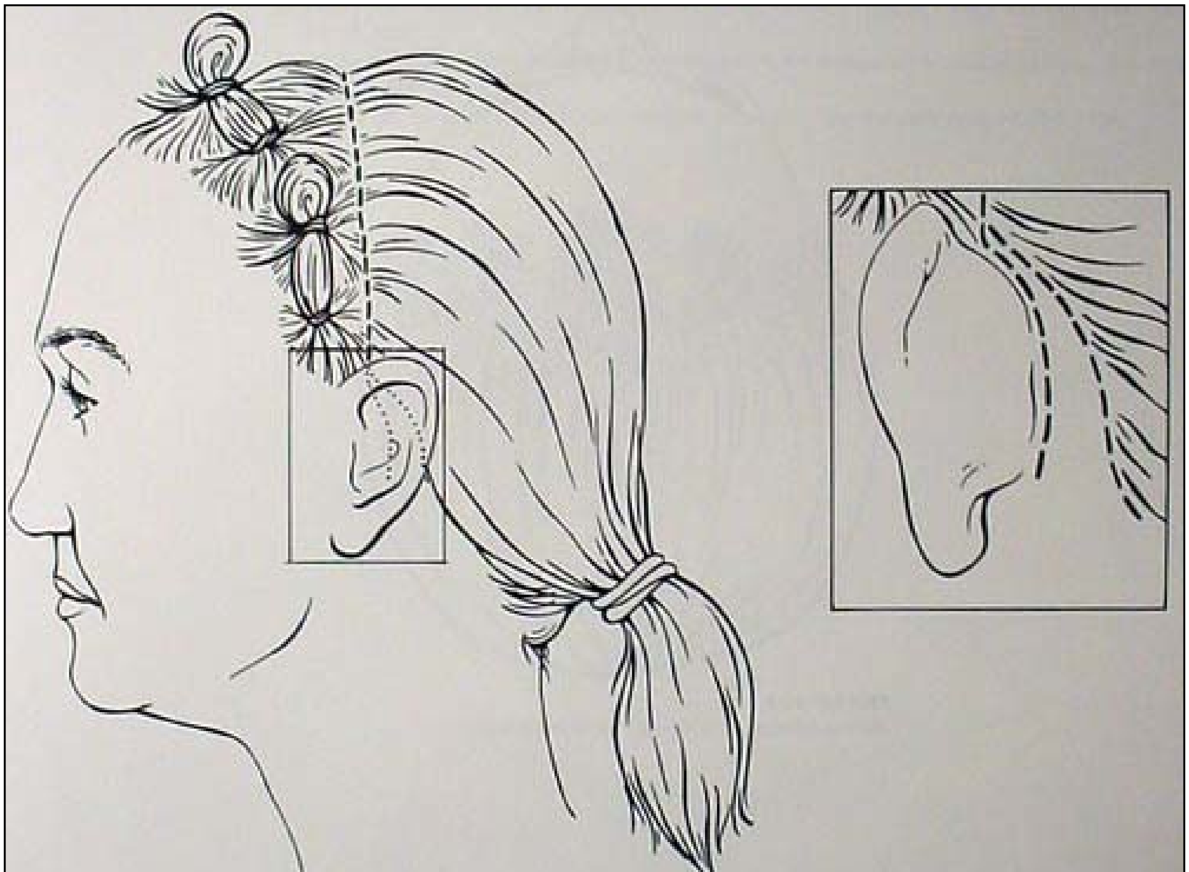


Figure 6-25 Postauricular placement of the coronal incision. The incision can be extended into the postauricular sulcus or within the hairline.

Even with well-placed incisions, the scar that forms may produce a separation of the hair that can become visible when the hair is wet, such as during swimming. A modification of the incision has been the use of a zig-zag incision instead of a straight incision within the hairline (Fig. 6-26) (7). The zig-zag incision helps break up the scar and make it less noticeable, even when the hair is worn short. The major disadvantage of this incision is the increased time needed for closure.

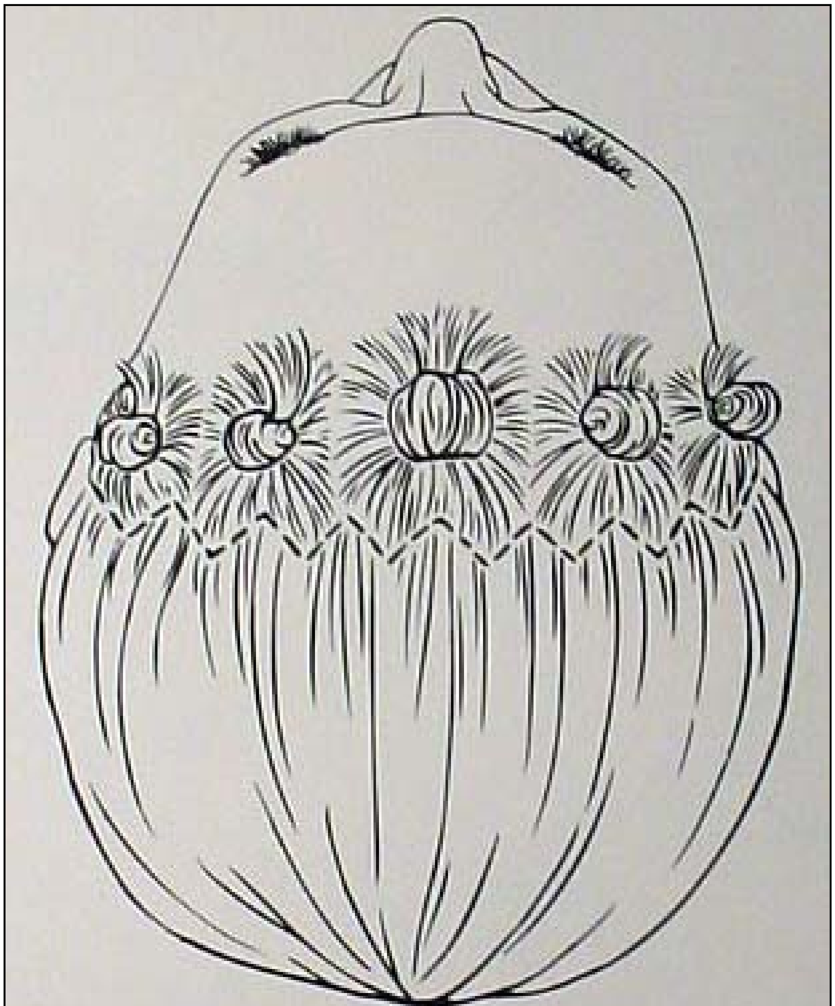


Figure 6-26 Zig-zag incision to make the scar less obvious.

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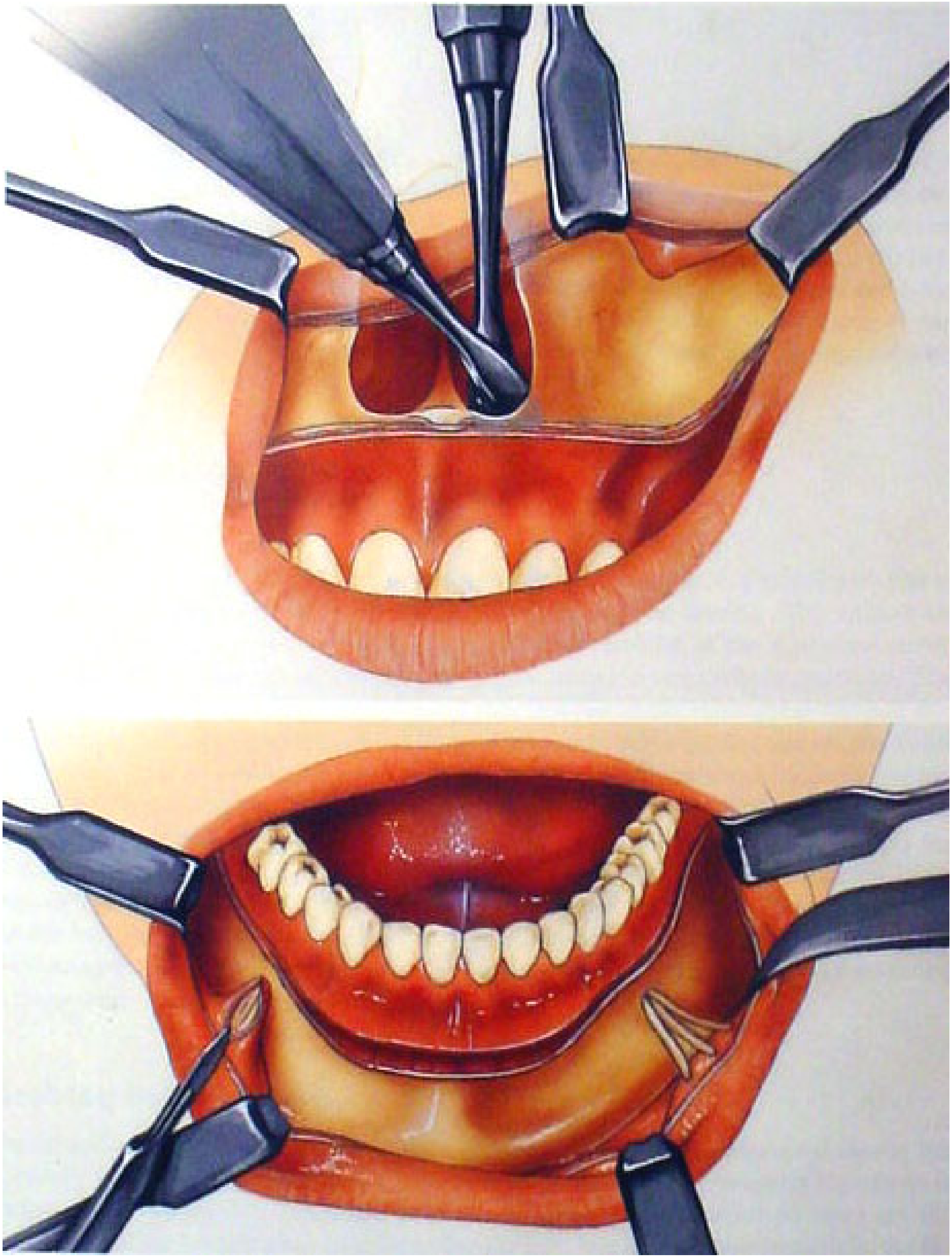
SECTION

IV TRANSORAL APPROACHES TO THE FACIAL SKELETON



The midfacial and mandibular skeleton can be readily exposed through incisions placed inside the oral cavity. The approaches are rapid and safe and the exposure is excellent. The greatest advantage of such approaches is the hidden scar. This section includes descriptions of maxillary and mandibular vestibular approaches to the facial skeleton.

7 Maxillary Vestibular Approach

The Maxillary vestibular approach is one of the most useful when performing any of a wide variety of procedures in the midface. It allows relatively safe access to the entire facial surface of the midfacial skeleton, from the zygomatic arch to the infraorbital rim to the frontal process of the maxilla. The greatest advantage of the approach is the hidden intraoral scar that result. The approach is also relatively rapid and simple, and complications are few. Damage to the branches of the facial nerve is nonexistent as long as one stays within the subperiosteal plane, and damage to the infraorbital nerve is unusual with proper technique.

SURGICAL ANATOMY

Infraorbital Nerve

The only neurovascular structure of any significance that must be negotiated with procedures in the midfacial region is the infraorbital neurovascular bundle. The infraorbital nerve is the largest cutaneous branch of the maxillary division of the trigeminal nerve. The artery and vein that accompany the infraorbital nerve are surgically insignificant. The nerve exits the infraorbital foramen, 7 to 10 mm inferior to the infraorbital rim just medial to the zygomaticomaxillary suture, or approximately at the medial and middle thirds of the orbit. The infraorbital nerve divides after exiting the infraorbital foramen into terminal branches that spread fanwise from into the lower eyelid; the nasal branches supply the skin on the lateral surface of the lower half of the nose. Three of the four superior labial branches enter the lip between its muscles and the mucous membrane. These nerves supply not only the mucous membrane of the upper lip, but also its skin, which they reach by perforating the orbicularis oris muscle. Damage to this nerve results in loss of sensation to these areas, and possibly dysesthesia.

As labial artery does

Nasolabial Musculature

The attachments of facial muscles of the nasolabial region may be disrupted during the maxillary vestibular approach. Therefore, these muscles should be properly repositioned during closure to prevent disturbing esthetic changes. The important muscles are the nasalis group, the levator labii superioris alaeque nasi, the levator labii superioris, The levator anguli oris, and the orbicularis oris (Fig. 7-1).

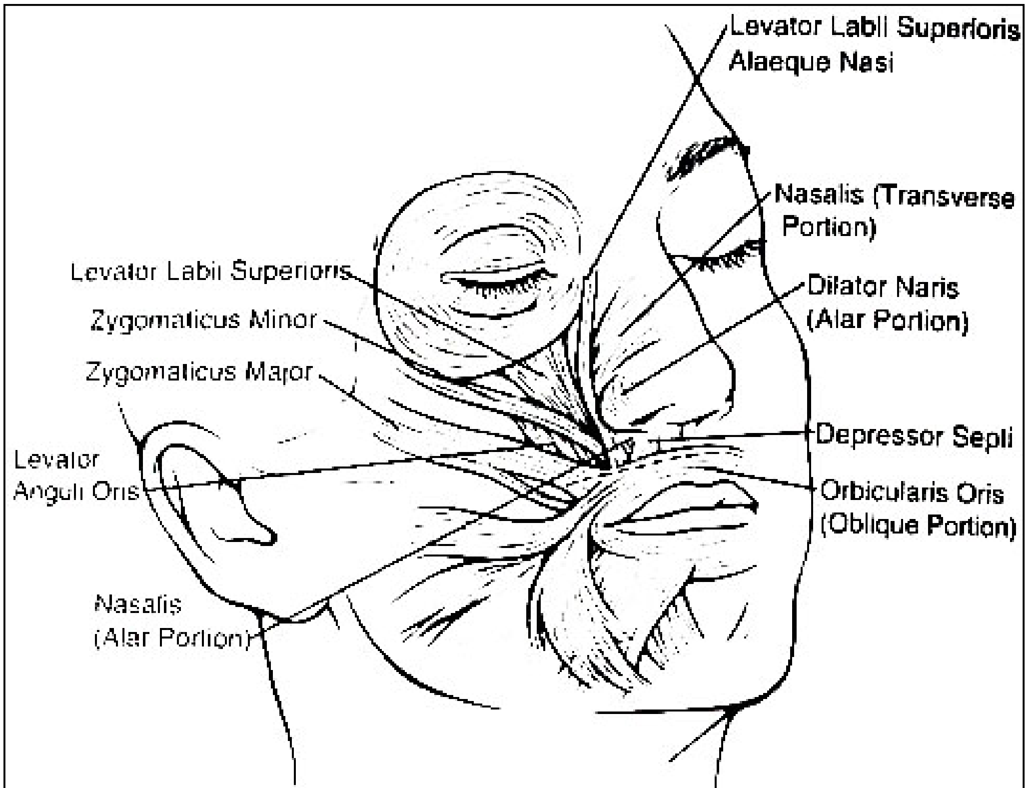


Figure 7- 1 Important facial musculature when performing the maxillary vestibular

The nasali group has transverse nasal and alar parts. It originates along the midline of the nasal dorsum and spreads laterally over the external aspect of the upper lateral cartilages where it intermingles with fibers of the levator labii superioris alaeque nasi and the levator labii superioris. Part of the transverse nasali inserts into the skin at the nasolabial groove, where it intermingles with fibers from the levator labii superioris alaeque nasi and oblique fibers of the orbicularis oris, forming a lateral nasal modiolus. Another portion of the transverse nasalis inserts onto the incisal crest and anterior nasal spine and is deeply in contact with the depressor septi muscle. The alar portion is ultimately reflected inward, forming the anterior floor of the nose.

Several muscle groups elevate the upper lip. The levator labii superioris alaeque nasi arises from the frontal process of the maxilla alongside the nose and passes obliquely in two segments. One segment inserts onto the lateral crus of the alar cartilage and skin of the nasalis muscle, depressor septi, and oblique bands of the orbicularis oris. The levator labii superioris arises from the infraorbital margin of the maxilla beneath the orbicularis oculi. It extends downward and medially, superficial to and intermingling with the orbicularis oris, beneath the skin of the ipsilateral lower philtral columns and the upper lip. The levator anguli oris muscle lies deep to the levator labii superioris and the zygomaticus muscle. It arises from the canine fossa of the maxilla and courses downward and medially to the commissure, where it intermingles with the fibers of the orbicularis oris muscle.

The orbicularis oris muscle consists of three distinct strata. Horizontal fibers extend from one commissure to the other, passing beneath the philtrum. Oblique bands extend from the commissures to the anteroinferior aspect of the nasal septal cartilage, anterior nasal spine, and floor of the nose. The incisal bands extend from the commissures deeply to insert onto the incisive fossa of the maxilla. All of these muscles and their investing fascia jointly contribute significantly to the position and configuration of the lateral nasal and labial regions.

The maxillary vestibular incision and the subperiosteal dissection attendant to this approach cut some of the muscular origins and strip the origins and insertions of most muscles from the bone (see Fig. 7-1), causing superolateral retraction of the tissue by the action of the zygomaticus muscles and the natural tendency for muscles to reattach in a shortened position. Lateral displacement of the nasal modiolus causes widening of the alar base with flaring of the alae from unopposed action of the dilator naris. This displacement causes deepening of the alar groove and splaying of the alar bases, nostrils, and nasal tip (Fig. 7-2). Loss of soft tissue fullness in the nasolabial region results in changes similar to those seen in the aging face: thinning and retraction of the upper lip, reduced vermilion exposure, and a more obtuse nasolabial angle. Downturning of the corners of the mouth may occur when the levators of the upper lip are detached from their origin, because the depressor of the mouth are then unopposed.

Premature aging

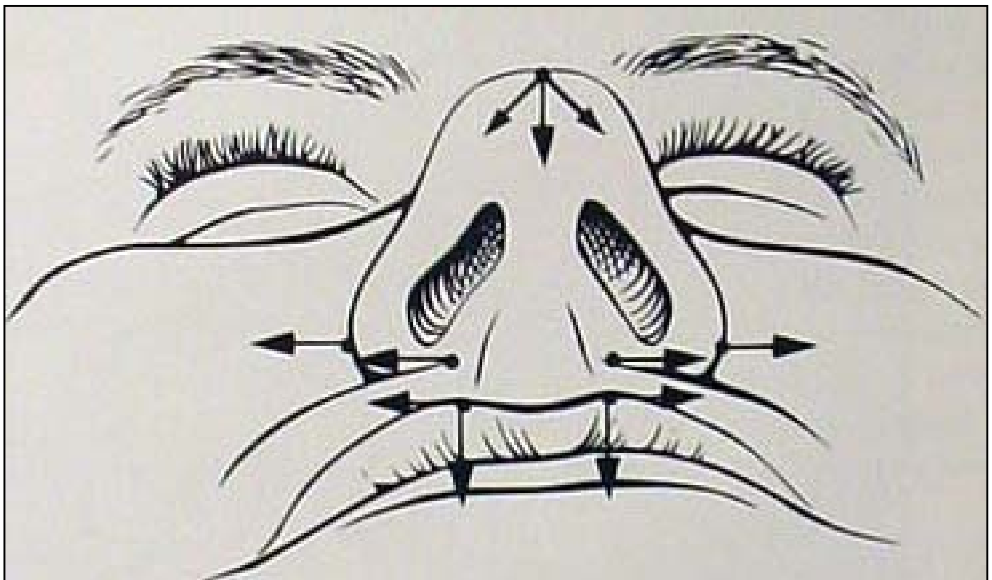


Figure 7- 2 Effects of the maxillary vestibular approach if simple closure is performed : the nasal tip loses projection, the alar bases widen, and the upper lip rolls inward.

Buccal Fat Pad

The buccal fat pad consists of a main body and four extensions: bucal, pterigoid, pterygomandibular, and temporal. The body is centrally positioned. The buccal extension lies superficially within the cheek, and the pterigoid, pterygomandibular, and temporal extension are situated more deeply.

The main body of the fat pad is located above the parotid duct and extends along the upper portion of the anterior border of the masseter. It then courses medially to rest on the periosteum of the posterior maxilla (Fig. 7-3). In this region, the body of the fat pad overlies the uppermost fibers of the buccinator muscle and travels forward along the vestibule overlying the maxillary second molar. Posteriorly, it wraps around the maxilla and travels through the pterygomaxillary fissure, where it is in intimate contact with branches of the internal maxillary artery and maxillary division of the trigeminal nerve.

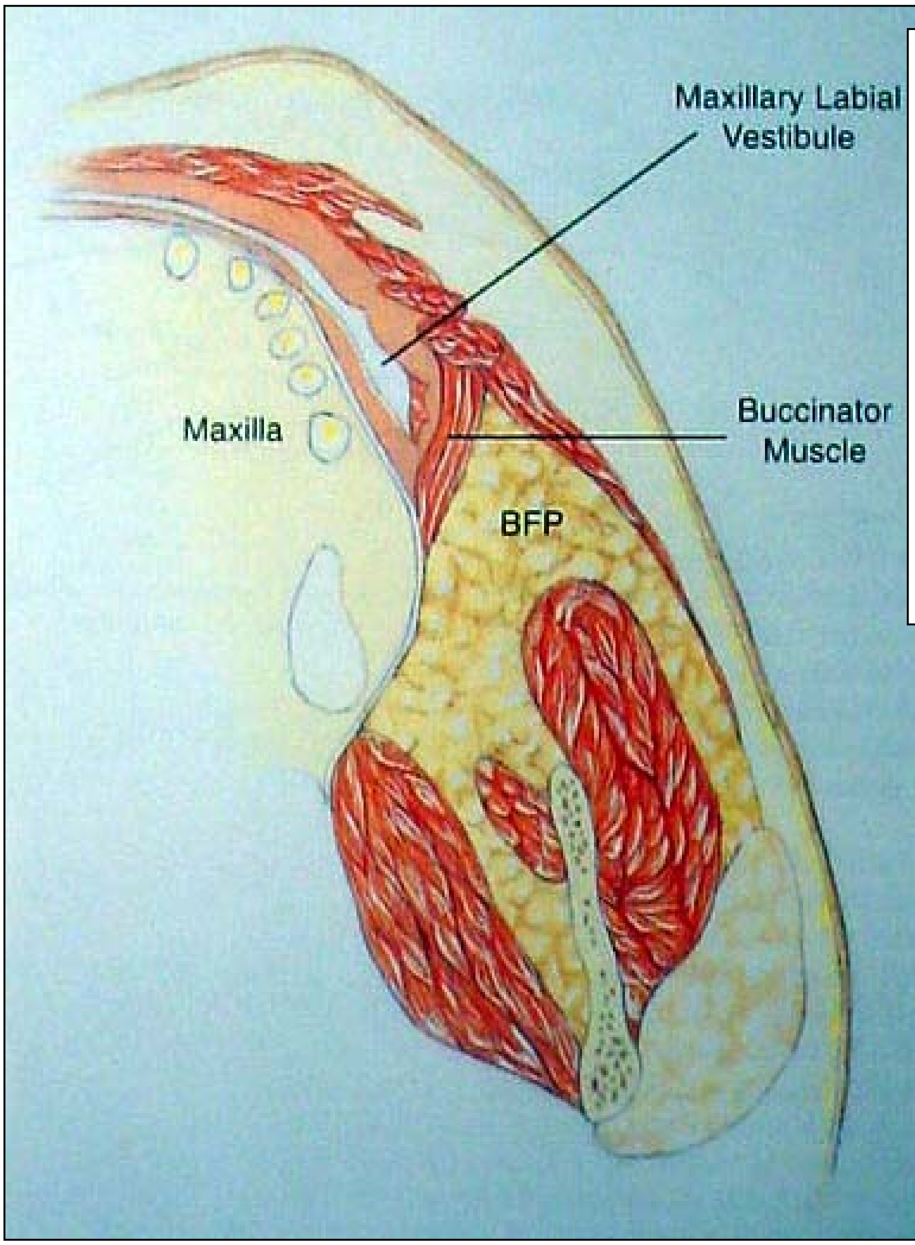


Figure 7- 3 Axial section through the maxilla at the level of the tooth root apices showing the relationship of the buccal fat pad (BFP) to the lateral maxilla. Note that the fat pad extends anteriorly to approximately the first molar. Also, posterior to the origin of the buccinator muscle on the maxilla, the buccal fat pad is just lateral to the periosteum.

TECHNIQUE

The facial surface of the midface can be exposed using the maxillary vestibular approach. The length of incision and amount of subperiosteal dissection depend on the area of interest and the extent of the surgical intervention. If the area of interest involves only one half of the midface, for instance with a unilateral zygomaticomaxillary fracture, the incision can be made on one side only, leaving the other side intact.

Step 1. Injection of a Vasoconstrictor

The oral mucosa, submucosa, and facial muscles are lushly vascularized. Submucosal injection of a vasoconstrictor can dramatically reduce the amount of hemorrhage during incision and dissection.

Step 2. Incision

The incision is usually placed approximately 3 to 5 mm superior to the mucogingival junction. Leaving unattached mucosa on the alveolus facilitates closure. This tissue has many elastic fibers and contracts following incision, although during closure, the tissue can be grasped and holds sutures well. The surgeon should not make the incision more superior in the anterior region because entrance into the piriform aperture, with puncture of the nasal mucosa, may result. Some individuals have extremely low piriform apertures, which makes this possibility a reality. Palpation of the inferior extent of the piriform aperture and/or anterior nasal spine ensures incision placement inferior to these structures. In the edentulous maxilla, where atrophy of the alveolar bone brings the alveolar crest and floor of the nose in close apposition, incision along the alveolar crest is an excellent choice.

The incision extends as far posteriorly as necessary to provide exposure, usually of the first molar tooth, and traverses mucosa, submucosa, facial muscles, and periosteum (Fig. 7-4). The mucosa retracts during incision, exposing underlying tissues.

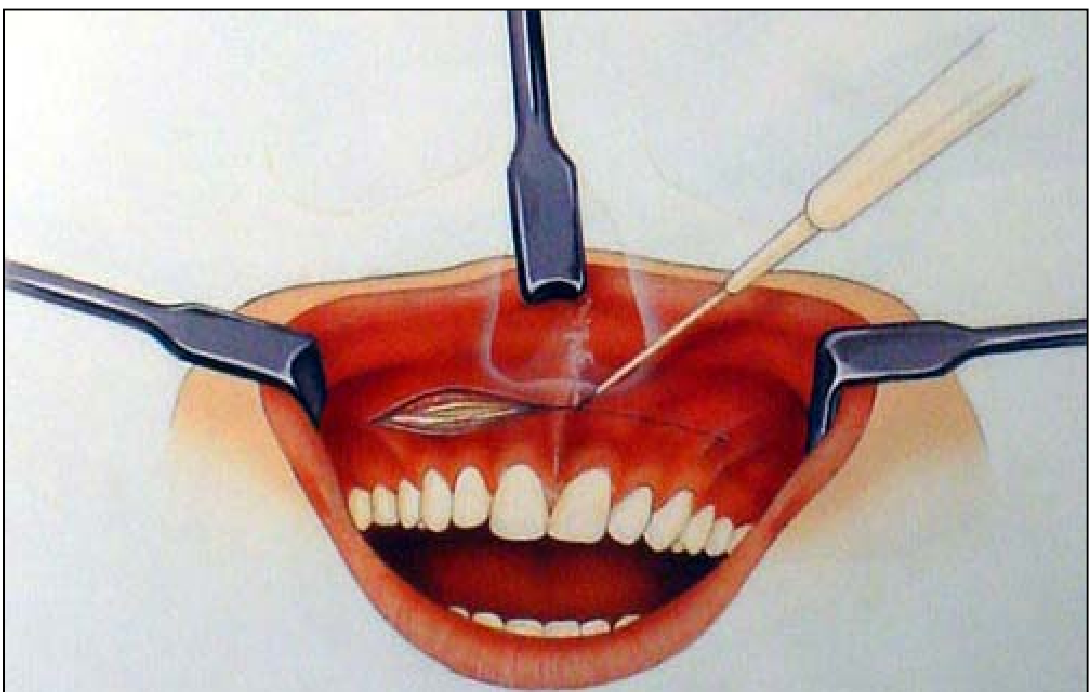


Figure 7- 4 Incision through the mucosa, submucosa, facial musculature, and periosteum.

Step 3. Subperiosteal Dissection of Anterior Maxilla and Zygoma

Periosteal elevators are used to elevate the tissues in the subperiosteal plane (Fig. 7-5). Dissection should be orderly, first elevating tissues superiorly, then along the piriform aperture, then posteriorly behind the zygomaticomaxillary buttress. While the tissues are elevated superiorly in the subperiosteal plane, small perforating vessels are encountered and are easily distinguishable from the infraorbital neurovascular bundle. The bundle is encountered and the periosteum is dissected completely around the foramen. Dissection proceeds superiorly to the infraorbital rim. Subperiosteal dissection along the piriform aperture strips the attachments of the nasolabial musculature, allowing upward and lateral retraction of the muscles.

Subperiosteal dissection proceeds posteriorly to the pterygomaxillary fissure. Perforation of the periosteum at or behind the zygomaticomaxillary buttress produces herniation of the buccal fat pad into the surgical field, a nuisance during surgery. A helpful suggestion is to keep the tip of the periosteal elevator always in an intimate contact with bone when proceeding posteriorly around the zygomaticomaxillary buttress. The only anatomic hazards are the infraorbital neurovascular bundle above and posterior superior alveolar vessels along the posterior maxilla, which infrequently cause bleeding.

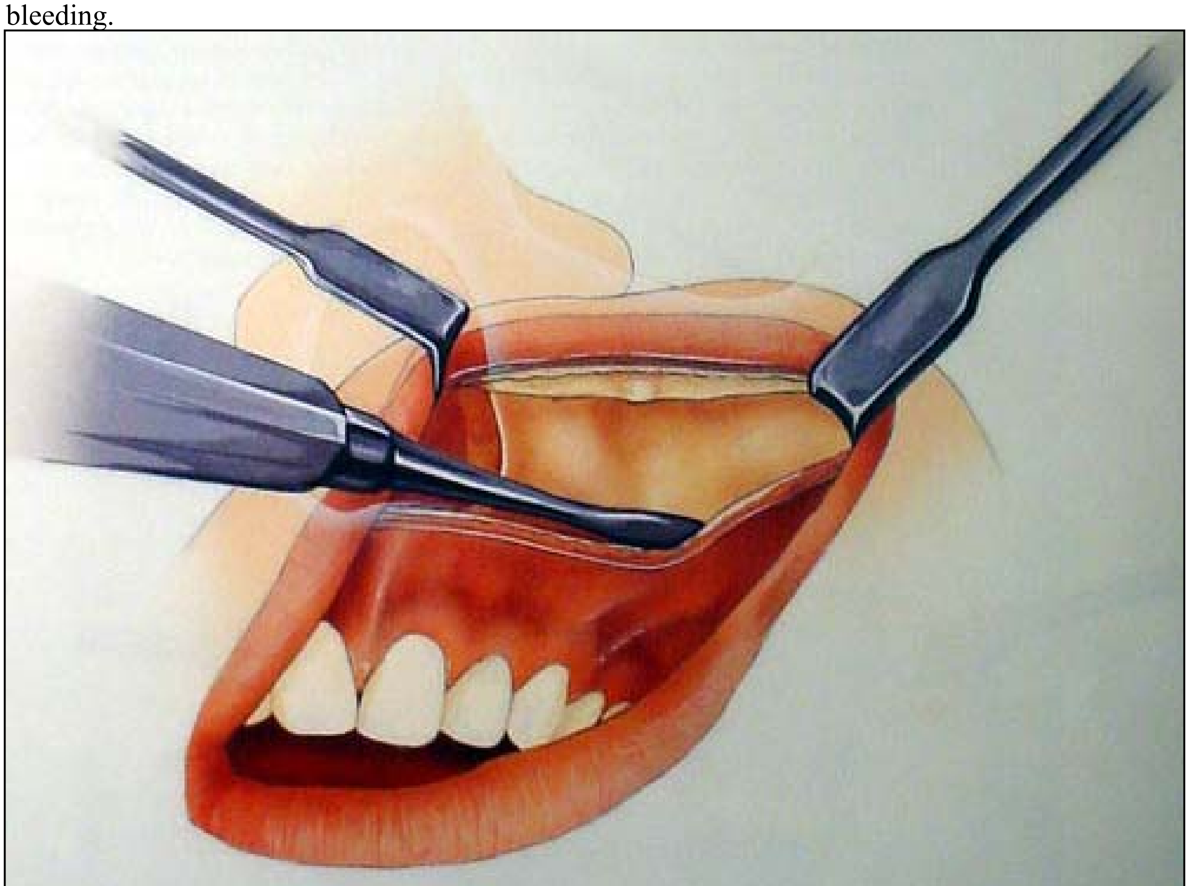


Figure 7- 5 Subperiosteal dissection of the anterior maxilla.

The entire anterior face of the zygoma can be easily exposed, but reaching the zygomatic arch necessitates detachment of some of the masseter muscle attachments. Sharp dissection is needed to free these tenacious fibers. Dissection below the piriform aperture up the anterior nasal spine should be performed carefully to maintain the integrity of the nasal mucosa. When violated, it bleeds profusely.

Step 4. Submucosal Dissection of Nasal Cavity

If it is necessary to strip the nasal mucosa from the lateral wall, floor, or septum of the nose, this maneuver is done carefully with periosteal or Freer elevators. A forked right-angle retractor is placed over the anterior nasal spine and subperiosteal dissection superiorly allows the retractor to retract the septum and nasal mucosa above the level of the anterior nasal spine. A scalpel is used to make a horizontal incision on top of the anterior nasal spine, freeing the cartilaginous septum from the top of the spine and thus the attachment of the nasal mucosa from the anterior nasal spine. The rim of the piriform aperture is thin and sharp, and the nasal mucosa is adherent. Periosteal elevators are used to strip the mucosa from the entire circumference of the piriform rim.

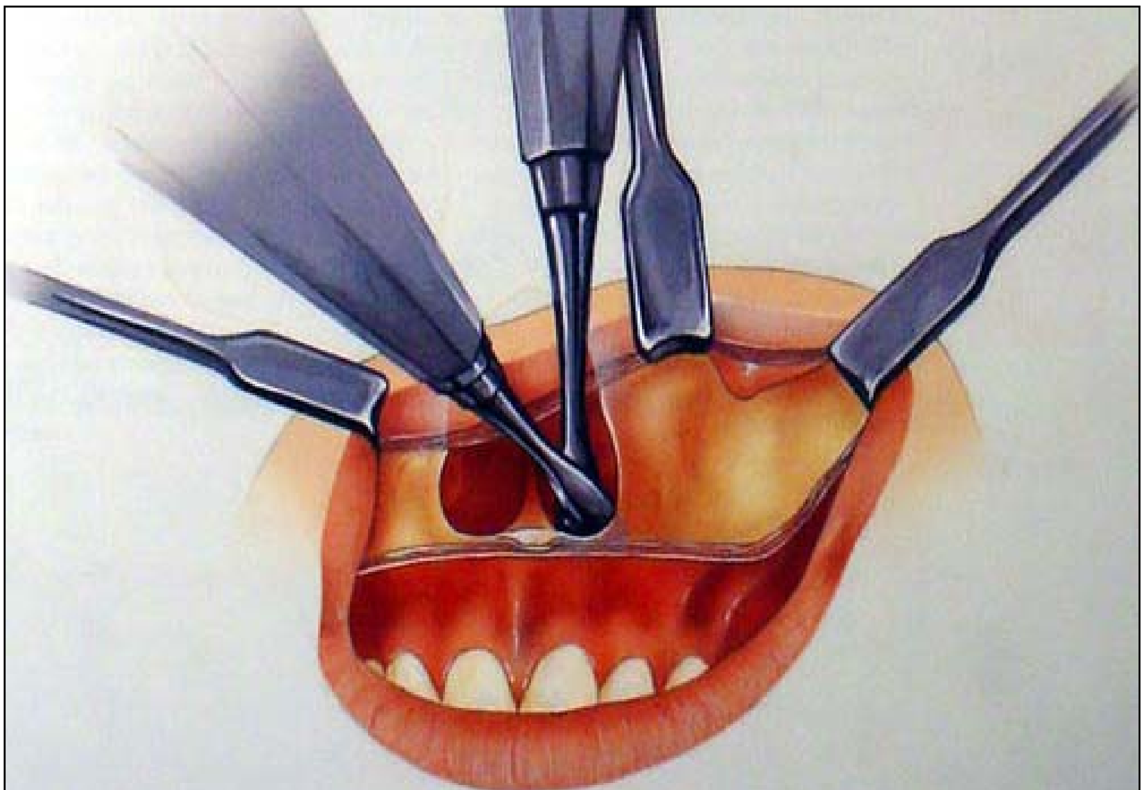


Figure 7- 6 Submucosal dissection of the nasal cavity. Note the tip of the periosteal elevators inside the piriform aperture.

Dissection into the nasal cavity is easiest to perform along the lateral wall and floor. The anteroinferior margin of the piriform rim is usually located above the nasal floor. Thus, after freeing the nasal mucosa from the piriform rim, the elevators should be inserted inferiorly before advancing posteriorly (Fig. 7-6). Dissection of the lateral wall of the nose is performed by gently inserting a periosteal elevator between the nasal mucosa and the lateral wall of the nasal cavity. It is not advanced deeply until the entire circumference of the lower one half of the piriform has been dissected. The previously taut nasal mucosa can then relax somewhat so that the elevator can be advanced more deeply along the lateral wall. The elevator is advanced in a sweeping motion to free the entire lateral wall and floor of its mucosa to the level of the inferior turbinate. The posterior edge of the nasal floor is approximately 45 mm posterior to the piriform aperture and can be felt when the elevator steps off the posterior edge.

Once the lateral wall and floor of the nose are stripped of mucosa, the elevator is placed at the junction of the floor of the nose and the nasal septum. A tenacious attachment of the mucosa to the septal crest of the maxilla must be carefully elevated to prevent perforation. A simple maneuver for stripping the septal mucosa from this approach is to place a Freer elevator along the junction of the septum and the floor of the nose and twist it so that the edge against the septum is twisted superiorly, freeing the mucosa on the septum.

Step 5. Closure

Restitution of the nasolabial muscles is performed as three uniform steps during closure of the maxillary vestibular incision. The first step involves identification and resetting of the alar bases, the second involves eversion of the tubercle and vermilion, and the last involves closure of the mucosa.

To help control the width of the alar base, an alar cinch suture is placed before suturing the lip. Suture placement is accomplished in one of two ways. With one technique, small toothed forceps placed through the vestibular incision grasp the insertion of the transverse nasalis muscle. Pulling the forceps medially allows one to see the change that occurs in the alar base. A slowly resorbing suture is passed through this tissue, taking care to engage adequate tissue to resist the pull of the suture, but not so much that a subcutaneous dimple occurs when the suture is pulled medially. The suture is then passed through the opposite side and temporarily tightened to examine the effect of the medial pull of the alar bases on the nose (Fig. 7-7). Another method is to evert the tissue into the incision area by pressing the thumb or finger into the alar facial groove (Fig. 7-8). A suture can then be passed through the incision, into the tissues, the depth of placement being guided by palpation of the thumb or finger. Whichever method is used to pass the suture through the nasalis muscle, the appearance must be symmetric and the desired curvature and definition of the alar base should be achieved after provisional tying. Tying the suture is delayed until a second suture is passed. The second suture is placed at a higher level or more laterally on the alar base, depending on the desired rotation of the ala. Generally, two sutures are adequate.

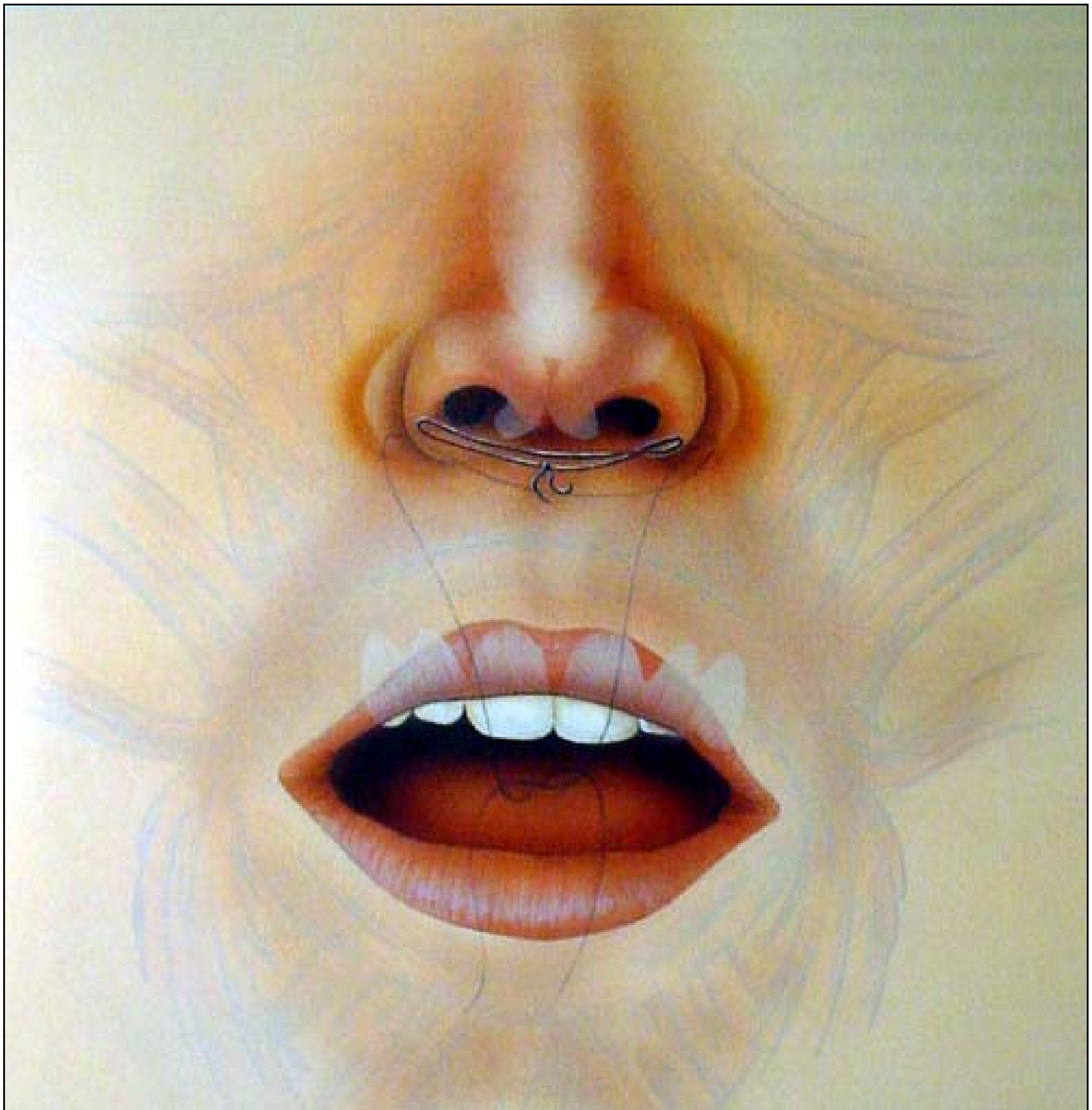


Figure 7- 7 Effect of the alar cinch technique of the width of the alar base. Note the difference after tying the suture.

Figure 7- 8 Tip of the finger (or thumb) everts the lip and nasal base while suture is passed.

A V-Y advancement closure of the maxillary vestibular incision is recommended where the incision has been placed across the base of the nose and subperiosteal dissection of the tissues along the piriform aperture has occurred. In closing the maxillary vestibular incision, a skin hook engages the labial mucosa incision in the midline and pills it away from the maxilla (Fig. 7-9). Three or four interrupted resorbable sutures are used to gather lip tissue in the midline. The mucosa and labia musculature are engaged by the needle on either side of the incision and then sutured. In most cases, 1 cm of tissue is closed in this manner, creating a pout in the midline of the lip. When this step is performed properly, the lip bulges anteriorly in the midline and the exposed vermillion is full. Within 7 to 10 days, this fullness gradually settles and a more normal appearance returns.

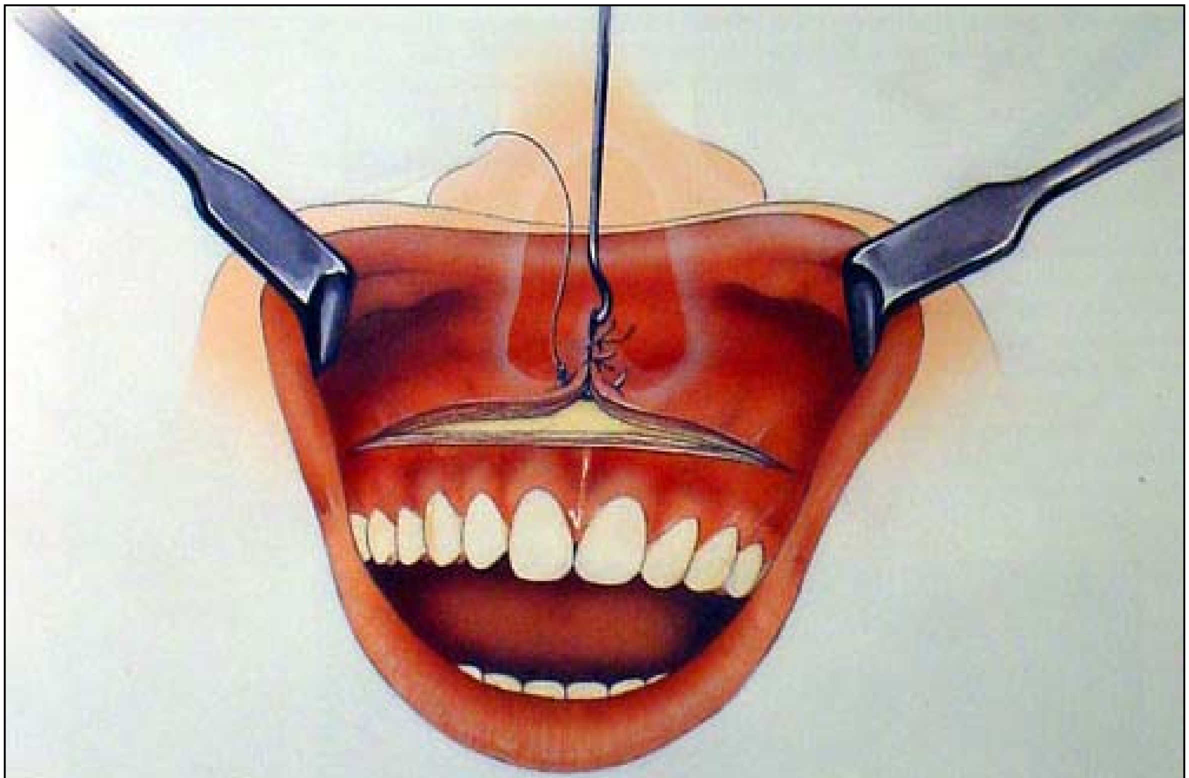


Figure 7- 9 V-Y closure of a lip incision. A skin hook is placed in the midline and tissue is gathered for approximately 1 cm with suture.

After closing the vertical limb of the V-Y advancement, a single suture is placed across the incision in the midline to ensure symmetric closure of the horizontal posterior incisions. When closing the horizontal incision, one should begin in the posterior and work anteriorly with a running resorbable suture (3-0 chromic catgut) through mucosa, submucosa, musculature, and periosteum. The superior aspect of the incision is gradually advanced toward the midline by passing the needle anteriorly in the lower margin of the incision as compared to the upper margin. This maneuver, in addition to the V-Y closure, helps lengthen the relaxed musculature so that it reattaches in its proper position (Fig. 7-10). From the canine-to-canine area, the suture is passed close to the edges of the incision to prevent gathering of the mucosa, which rolls the lip inward and reduces the amount of exposed vermilion.

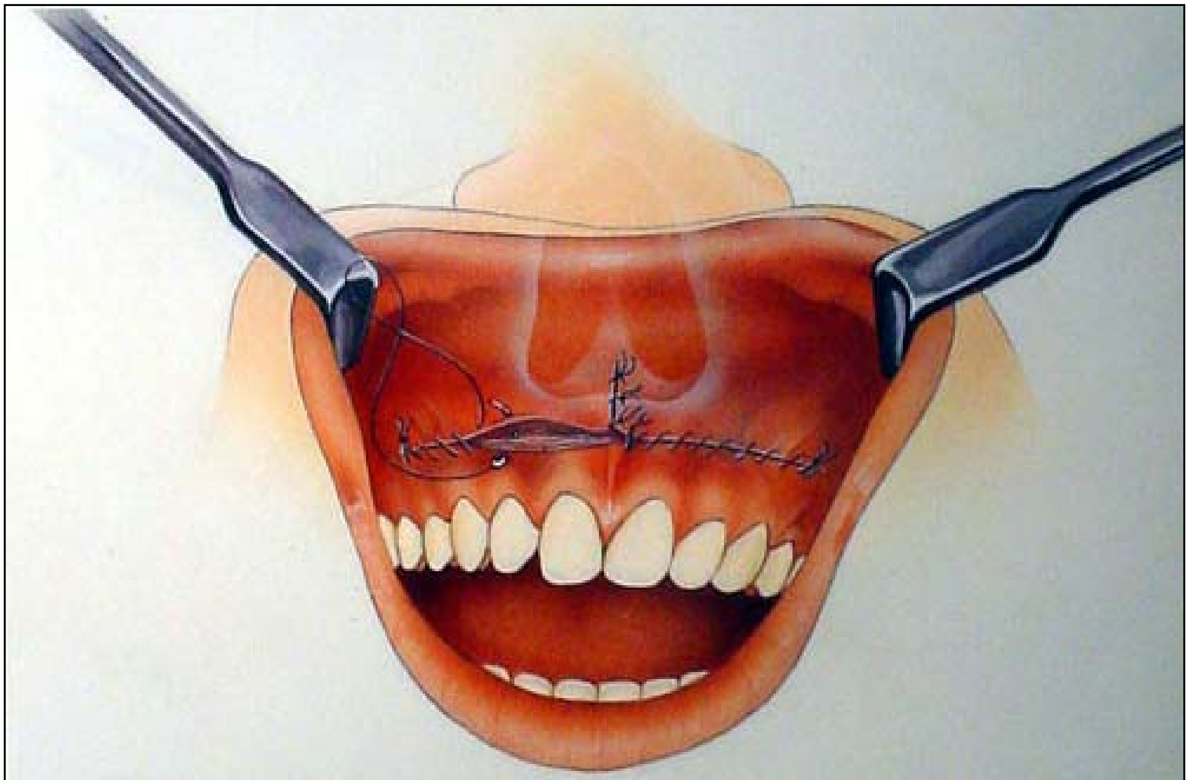


Figure 7- 10 The remainder of the incision is closed so that the superior edge is pulled anteriorly.

8 Mandibular Vestibular Approach

The mandibular vestibular approach if useful for a wide variety of procedures. It allows relatively safe access to the entire facial surface of the mandibular skeleton, from the condyle to the symphysis. An advantage of this approach is the ability of constantly access the dental occlusion during surgery. The greatest benefit to the patient is the hidden intraoral scar. The approach also relatively rapid and simple, although access is limited in some regions, such as the lower border of the mandible at the angle and parts of the ramus. Complications are few but include mental nerve damage and lip malposition, both of which are minimized with proper technique.

SURGICAL ANATOMY

Mental Nerve

The only neurovascular structure of any significance that must be negotiated with procedures in the mandibular body/symphysis region is the mental neurovascular bundle. The artery and vein that accompany the mental nerve are insignificant from a surgical standpoint. The mental nerve is a terminal branch of the inferior alveolar nerve (mandibular nerve), and provides sensory innervation to the skin and mucosa of the lower lip, the skin in the region of the chin, and the facial gingiva of the anterior teeth.

The mental nerve exists the mental foramen, located midway between the alveolar and basal borders of the mandible and usually below or slightly anterior to the second bicuspid tooth (Fig. 8-1). The mental nerve divides under the depressor anguli oris muscle into three main branches; one

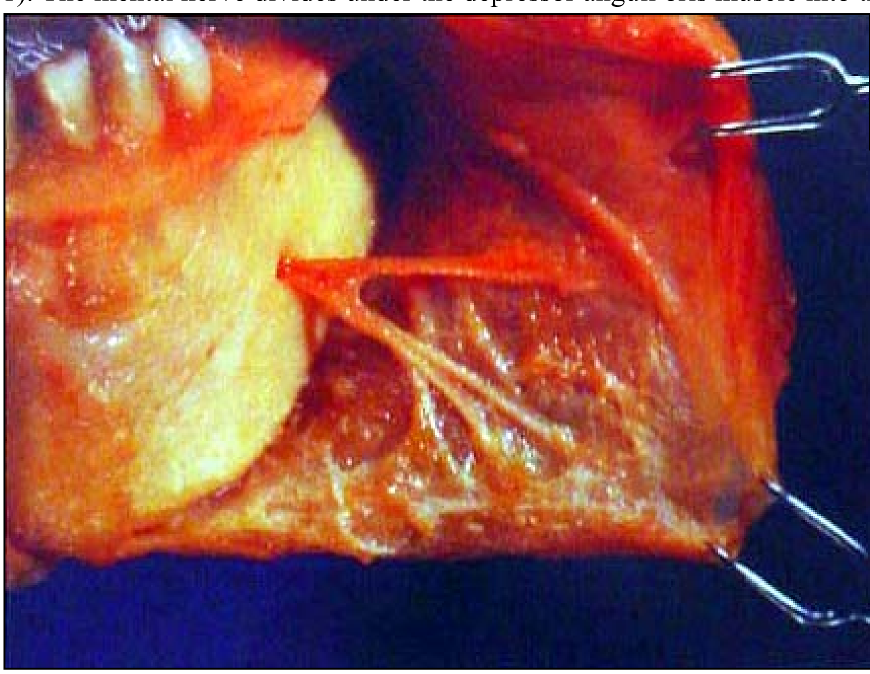


FIGURE 8- 1 Anatomic dissection of mental nerve branches.

descends to the skin of the chin and the other two ascend to the skin and mucous membrane of the lower lip and gingiva. The branching pattern is variable, however, and several finer branches may be noted. As the branches enter the lower lip, they become superficial and can usually be seen just beneath the mucosa of the lower lip when it is everted.

Facial Vessels

The facial artery and vein are usually not encountered during the mandibular vestibular approach unless dissection through the periosteum occurs in the region of the mandibular anterogonial notch.

The facial artery arises from the external carotid artery in the carotid triangle of the neck. At or close to its origin, it is crossed by the posterior belly of the digastric muscle, the stylohyoid muscles, and the hypoglossal nerve. In the submandibular triangle, the facial artery ascends deep to the submandibular gland, grooving its deep and superior aspect, and passes superficially to reach the inferior border of the mandible. As it crosses the mandible at the anterior border of the masseter muscle, the artery is covered on its superficial surface by skin and platysma muscle, and its pulsation can be felt at this location.

The facial vein is the drainage vein of the angular and ultimately the labial vessels. It is usually located more posterior and superficial to the artery. Of surgical significance, however, is the fact that the facial artery and vein are close to the mandible in the region of the inferior border. The only structure separating them from the bone is the periosteum (Fig. 8-2).

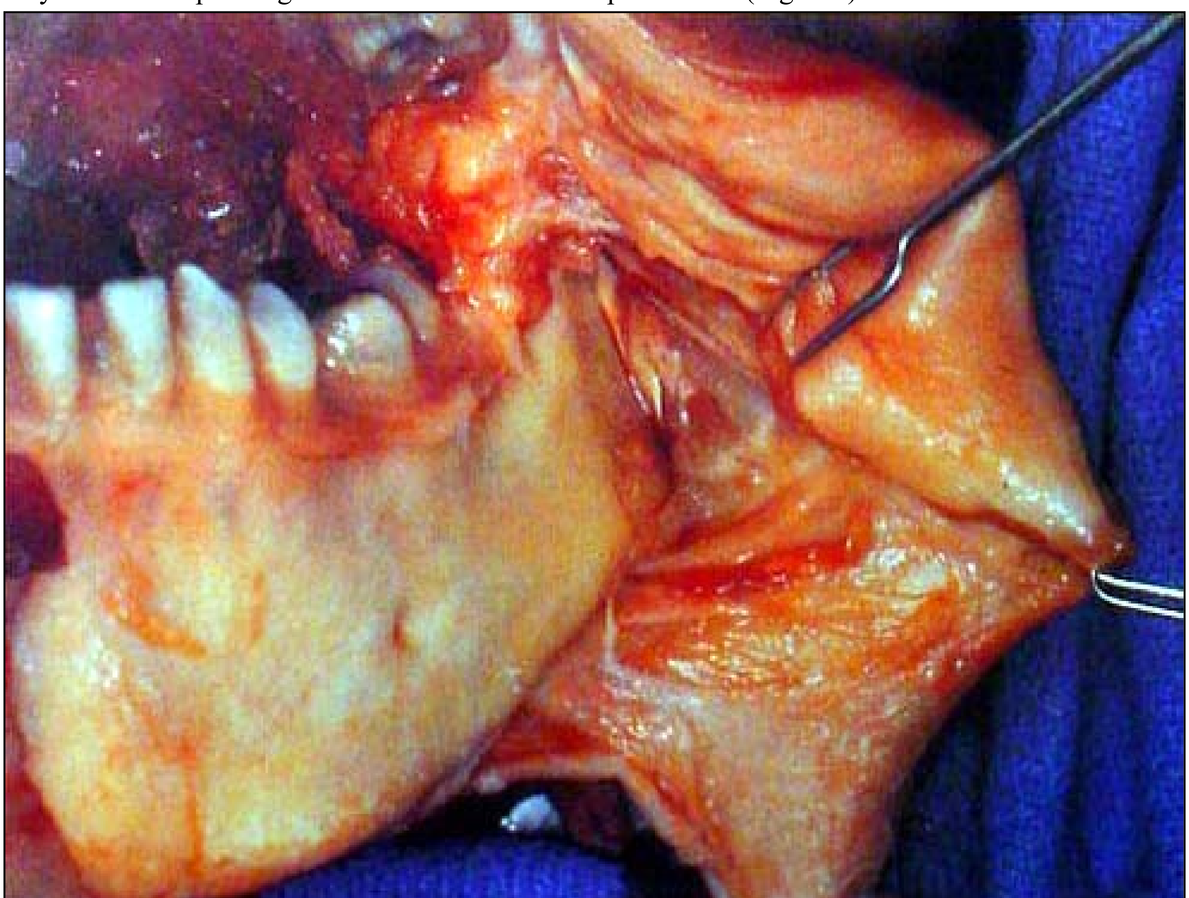


FIGURE 8- 2 Anatomic dissection of the mandibular body showing relationship of facial vessels to bone. The only tissue between them is the periosteum.

The only muscle of facial expression that is important from a surgical standpoint when using the mandibular vestibular approach is the mentalis muscle. All of the other muscles of facial expression are stripped from the mandible by subperiosteal dissection and are readily reattached with soft tissue closure. The mentalis muscle is unique, however, in that it is the only elevator of the lower lip and chin. If this muscle is not properly repositioned during closure, the chin will "droop" and the lower lip will take on a lifeless, sagging appearance, exposing more lower teeth.

The mentalis muscle are paired, small, conical muscles arising from the mandible, beginning at the midroot level of the lower incisor teeth and continuing inferiorly to a point below the apices. They are separated from one another by a firm septum and adipose tissue.

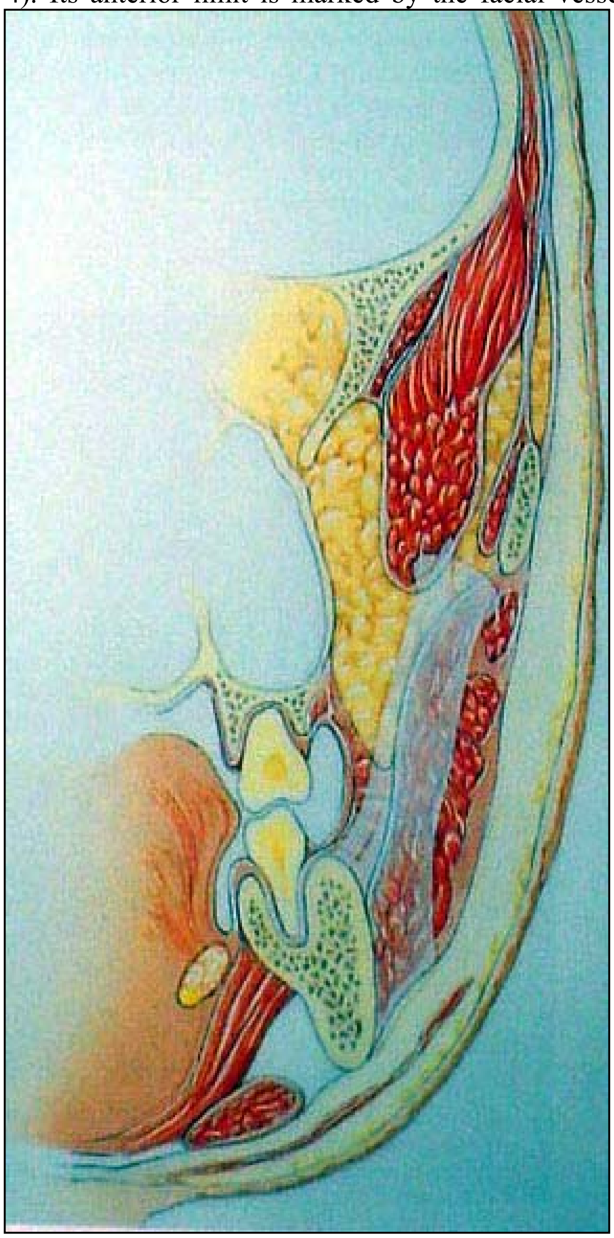
At the inferior portion of its origin, the mentalis muscle attaches lateral to the pogonial trigone. The fibers of this muscle pass from their origin inferiorly, inserting into the skin of the chin at the soft tissue chin prominence (Fig. 8-3). The most superior fibers are the shortest and pass almost horizontally into the skin of the upper chin. The lower fibers are the longest and pass obliquely or vertically to the skin at the lower part of the chin. The origin of the mentalis muscle determines the depth of the labial sulcus in the anterior portion of the mouth. The mentalis muscle is innervated by the marginal mandibular branch of the facial nerve.

FIGURE 8- 3 Anatomic dissection showing cross section of soft tissues of the chin. Note the direction of the mentalis muscle fibers.

Buccal Fat Pad

The buccal fat pad consists of a main body and four extensions : buccal, pterygoid, pterygomandibular, and temporal. The body is centrally positioned. The buccal extension lies superficially within the cheek and the pterygoid, pterygomandibular, and temporal extensions are more deeply situated.

The buccal extension is the most superficial segment of the fat pad and imparts fullness to the cheek. It enters the cheek below the parotid duct and extends along the anterior border of the masseter as it descends into the mandibular retromolar region. It overlies the main portion of the buccinator muscle as it crosses the cheek. In the cheek, the fat is anterior to the ramus. Its caudal extension intraorally is on a plane tangential with the occlusal surface of the mandibular third molar (Fig. 8-4). Its anterior limit is marked by the facial vessels, which are in the same plane as the



buccal

fat pad. The parotid duct lies superficial to the fat pad and then penetrates the fat pad and buccinator to enter the oral cavity opposite the second molar. The buccal extension of the fat pad is limited by the masseteric fascia. A deep extension of the masseteric fascia blends with the fascia along the lateral surface of the buccinator. This fascial layer lines the deep surface of the buccal fat that is in contact with the buccinator.

TECHNIQUE

For demonstration purposes, the technique subsequently described is that used to expose the entire surface of the mandible. The length of the incision and the extend of subperiosteal dissection, however, depend on the area of interest and the extent of surgical intervention.

Step 1. Injection of Vasoconstrictor

The oral mucosa, submucosa, and facial muscle are lushly vascularized. Submucosal injection of a vasoconstrictor can dramatically reduce the amount of hemorrhage during incision and dissection.

Step 2. Incision

In the anterior region, from canine to canine, the lower lip is everted and a scalpel or electrocautery is used to incise the mucosa. The incision is curvilinear, extending anteriorly out into the lip, leaving 10 to 15 mm of mucosa attached to the gingiva. Once through the mucosa, the underlying mentalis muscle are clearly visible (Fig. 8-5). The muscle fibers are sharply incised in an oblique approach to the mandible (Fig. 8-6). When bone is encountered, an ample amount of mentalis muscle should remain on its origin for holding deep sutures at closure.

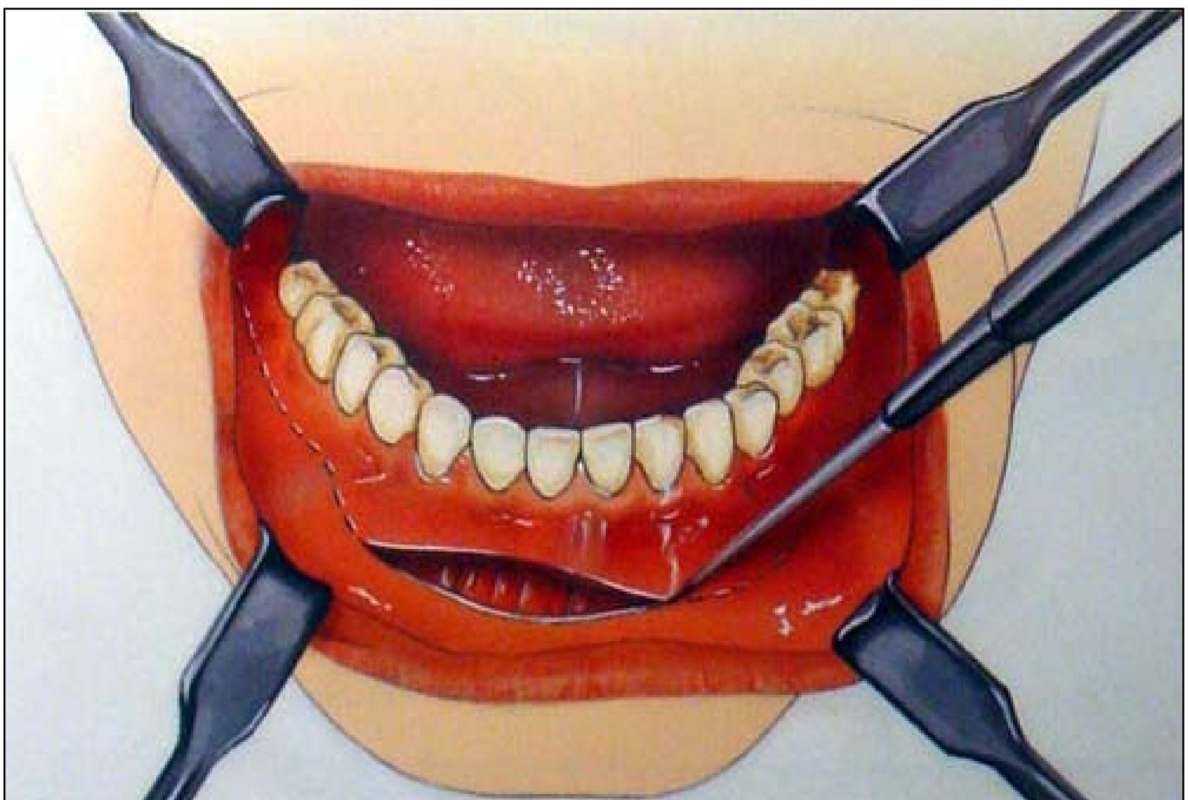


FIGURE 8- 5 Incision through the oral mucosa in the anterior region is out in the lip, exposing the underlying mentalis muscle fibers.

In the body and posterior portion of the mandible, the incision is placed 3 to 5 mm inferior to the mucogingival junction. Leaving unattached mucosa on the alveolus facilitates closure. Any incision placed more inferior in the canine/premolar region may sever branches of the mental nerve. The scalpel should be perpendicular to bone when incising above the mental foramen to prevent incision of this nerve.

The posterior extend of the incision is made over the external oblique ridge, traversing mucosa, submucosa, buccinator muscle, buccopharyngeal fascia, and periosteum (see Fig. 8-5). The incision is usually no more superior then the occlusal plane of the mandibular teeth to help prevent herniation of the buccal fat pad into the surgical field, a nuisance during surgery. The buccal portion of the buccal fat pad is usually not more inferior than the level of the occlusal plane (see Fig 8-4). Placement of the incision at this level also may spare severing the buccal artery and nerve, although damage to them is more a nuisance than a clinical problem. If the buccal artery is severed, it is easily controlled by coagulation.

In the edentulous mandible, the incision is made along the alveolar crest, splitting the attached gingiva. This placement facilitates closure and minimizes risk to the mental nerve. Alveolar atrophy brings the inferior alveolar neurovascular bundle and the mental foramen to the superior surface of the bone. In these instances, crestal incision behind and in front of the mental foramen, which is easily located by palpation, are joined following subperiosteal dissection to identify the exact location of the mental nerve. Posteriorly, the incision leaves the crest at the second molar region and extends laterally to avoid the lingual nerve, which may be directly over the third molar area. Placing the incision over the ascending ramus helps to avoid the lingual nerve.

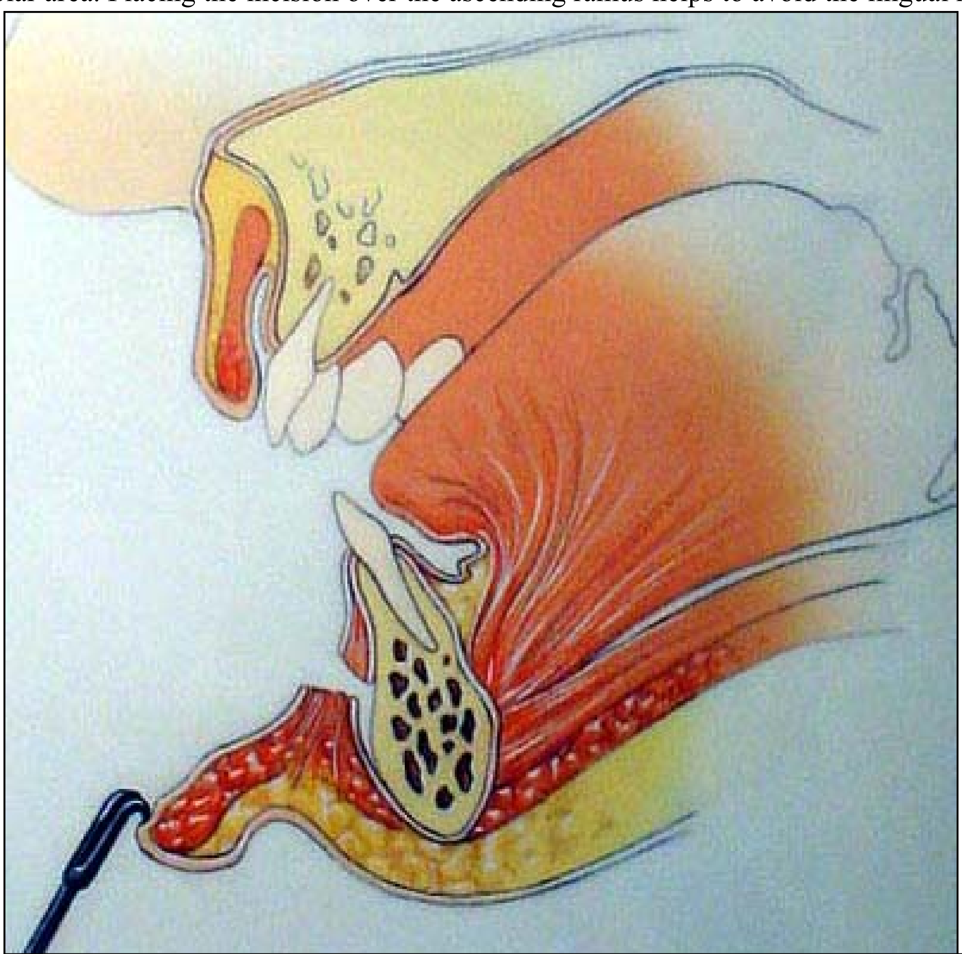


FIGURE 8- 6 Cross section of the symphysis showing the path of dissection

Step 3. Subperiosteal Dissection of the Mandible

The mentalis muscle is stripped from the mandible in a subperiosteal plane. Retraction of the labial tissues is facilitated by stripping them off the inferior border of the symphysis. Subperiosteal dissection of the mandibular body is relatively simple compared to that of the symphysis because there are fewer Sharpey's fibers inserting into the bone. Controlled dissection and reflection of the mental neurovascular bundle facilitate retraction of the soft tissue away from the mandible. The periosteum is totally freed circumferentially around the mental foramen and nerve. Retracting the facial tissues laterally will gently tense the mental nerve. Using a scalpel, the surgeon then incises the stretched periosteum longitudinally, paralleling the nerve fibers (Fig. 8-7), in two or three locations. The sharp end of a periosteal elevator teases the periosteum away from the mental foramen and nerve. Any remaining periosteal attachments are dissected free with sharp scissors. This stripping allows mobilization on the branches of the mental nerve, facilitating facial retraction and augmenting exposure of the mandible. Dissection can then proceed posteriorly along the lateral surface of the mandibular body/ramus. The surgeon should stay within the periosteal envelope to prevent lacerating the facial vessels, which are just superficial to the periosteum (see Fig. 8-2).

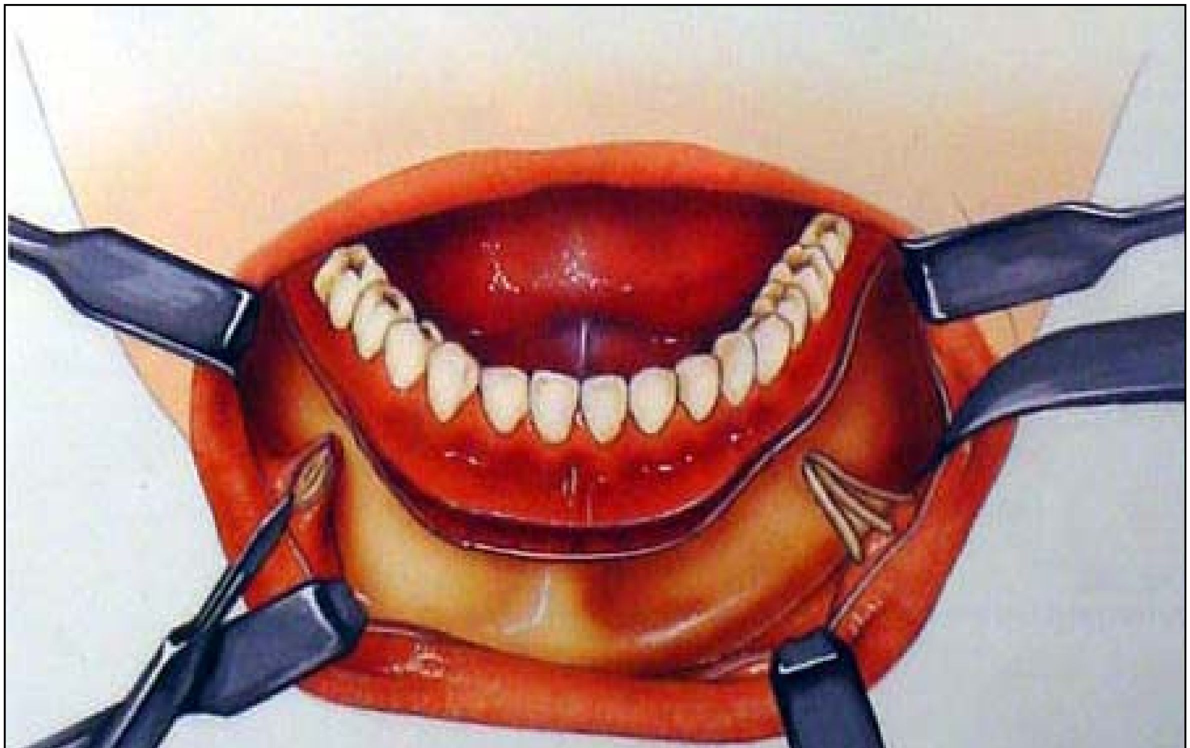


FIGURE 8- 7 Dissection of the mental nerves. The periosteum is incised and the periosteum is stripped laterally to expose nerve branches.

Subperiosteal dissection up the anterior edge of the ascending ramus strips the buccinator attachments, which allows the muscle to retract upward, minimizing the chance of herniation of the buccal fat pad (see Fig. 8-4). Temporalis muscle fibers may be easily stripped by inserting the sharp end of a periosteal elevator between the fibers and the bone as high on the coronoid process as possible, and stripping downward (Fig 8-8). A notched right-angle retractor (Fig. 8-9) may be placed on the anterior border of the coronoid process to retract the mucosa, buccinator, and temporalis tendon superiorly during stripping. Stripping some of the tissue from the medial side of the ramus will widen the access. After stripping of the upper one third of the coronoid process, a curved Kocher clamp can be used as a self-retaining retractor grasping the coronoid process.

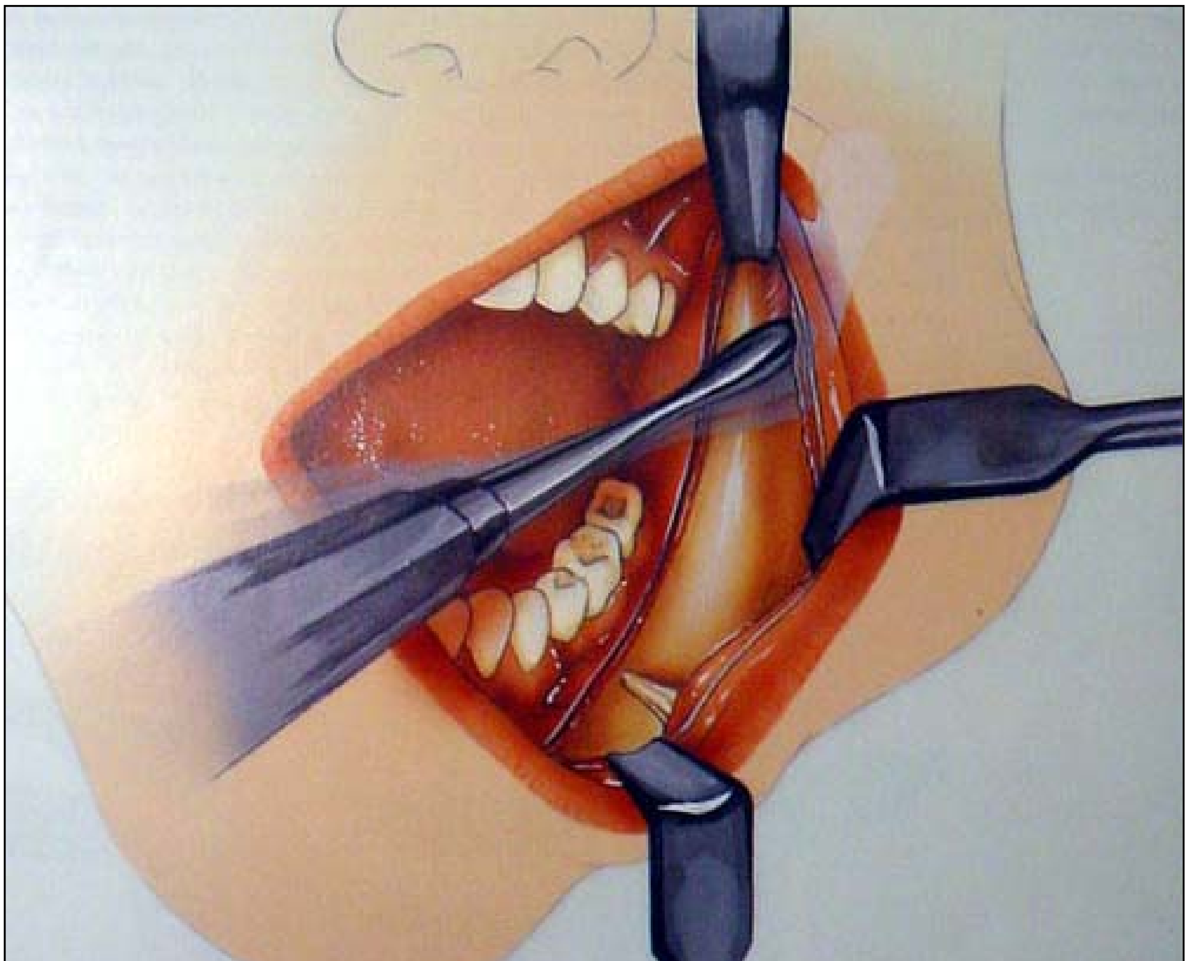


FIGURE 8- 8 Subperiosteal dissection of the ramus.

While the buccal tissues are retracted laterally with a right-angle retractor, the masseter muscle is stripped from the lateral surface of the ramus (see Fig. 8-8). Sweeping the periosteal elevator superoinferiorly cleanly strips the muscle from the bone. Although direct visualization may be poor, the posterior and inferior borders of the mandible are readily stripped of the pterygomasseteric fibers using periosteal elevators, J-strippers, or both. Dissection can continue superiorly, exposing the condylar neck and the entire sigmoid notch. To maintain exposure of the ramus, Bauer retractors (Fig. 8-10) inserted into the sigmoid notch and/or under the inferior border are useful (Fig. 8-11). The LaVasseur-Merrill retractor is another useful device that slides behind and clutches the posterior border of the mandible to hold the masseter in a lateral position.

FIGURE 8- 9 Notched right-angle retractor. The V-shaped notch is posittioned on the ascending ramus and the retractor is pulled superiorly to retract tissues.

FIGURE 8- 10 Bauer retractors. The flanges at right angle to the shaft are used to engage the sigmoid notch and/or inferior border of the mandible, allowing retraction of the masseter muscle.

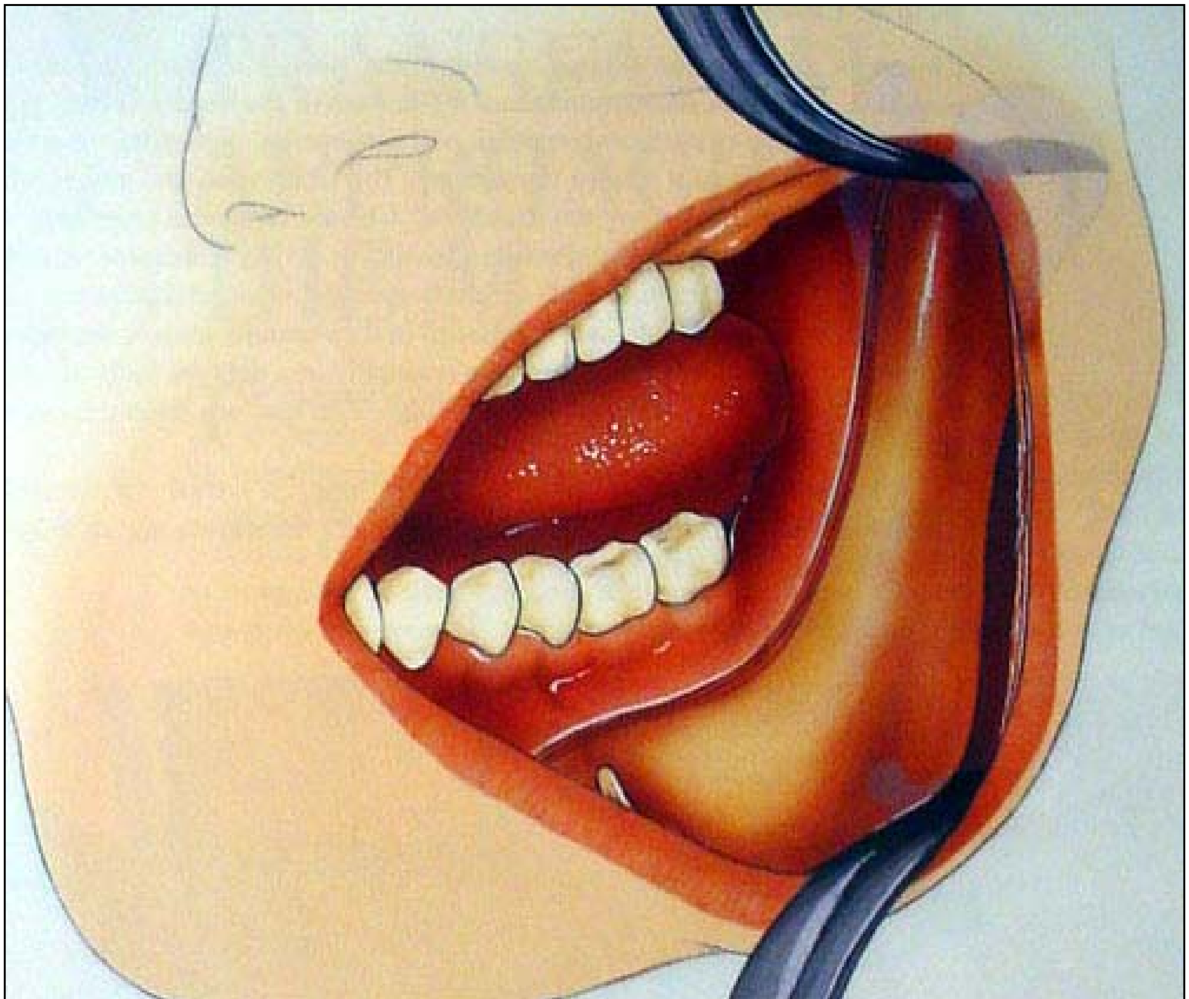


FIGURE 8- 11 Exposure after insertion of Bauer retractors. Note that the flange of one retractor is in the sigmoid notch and the flange of the other is under the inferior border of the mandible.

Step 5. Closure

Closure is adequate in one layer, except in the anterior region. Closure may begin in the posterior areas with resorbable suture. The pass of the needle should grab mucosa, submucosa, cut edge of the facial muscles, and periosteum, if possible. A simple mucosal closure is inadequate as it allows retraction of the facial muscles, which will heal in an abnormally low position along the mandible. Closure continues anteriorly to the area of the cuspid tooth. At this point, the suture is tied (Fig. 8-12). It is imperative that the mentalis muscle be firmly reattached to its origin to prevent ptosis of the lip and chin. A minimum of three deep resorbable sutures are placed in the mentalis muscle to reapproximate the cut edges (see Fig. 8-12). Their placement is usually in a delayed fashion, allowing retraction to improve access for all three before tying. The mucosa from canine to canine is then closed with a running resorbable suture.

A suspension dressing, such as elastic tape, is useful for several days after the mandibular buccal vestibular approach to prevent hematoma and to maintain the position of the repositioned facial muscles.

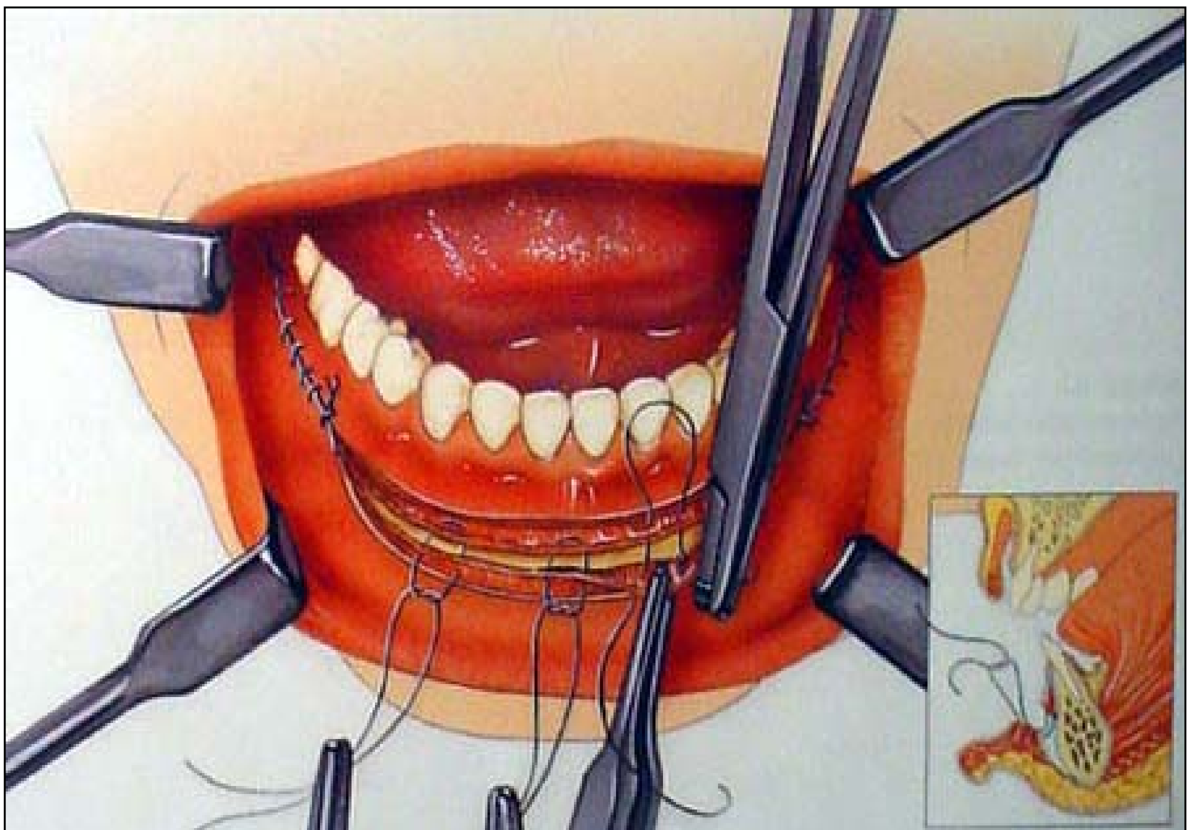


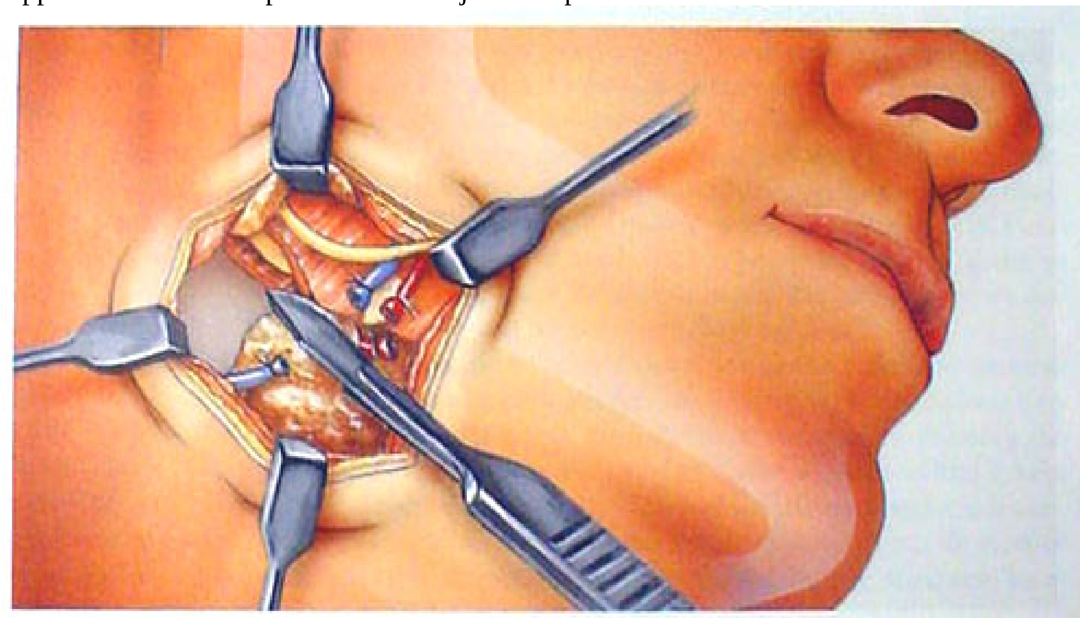
FIGURE 8- 12 Closure of the posterior incision is performed in one layer. In the anterior region, delayed sutures are placed in the mentalis muscle before mucosal closure.

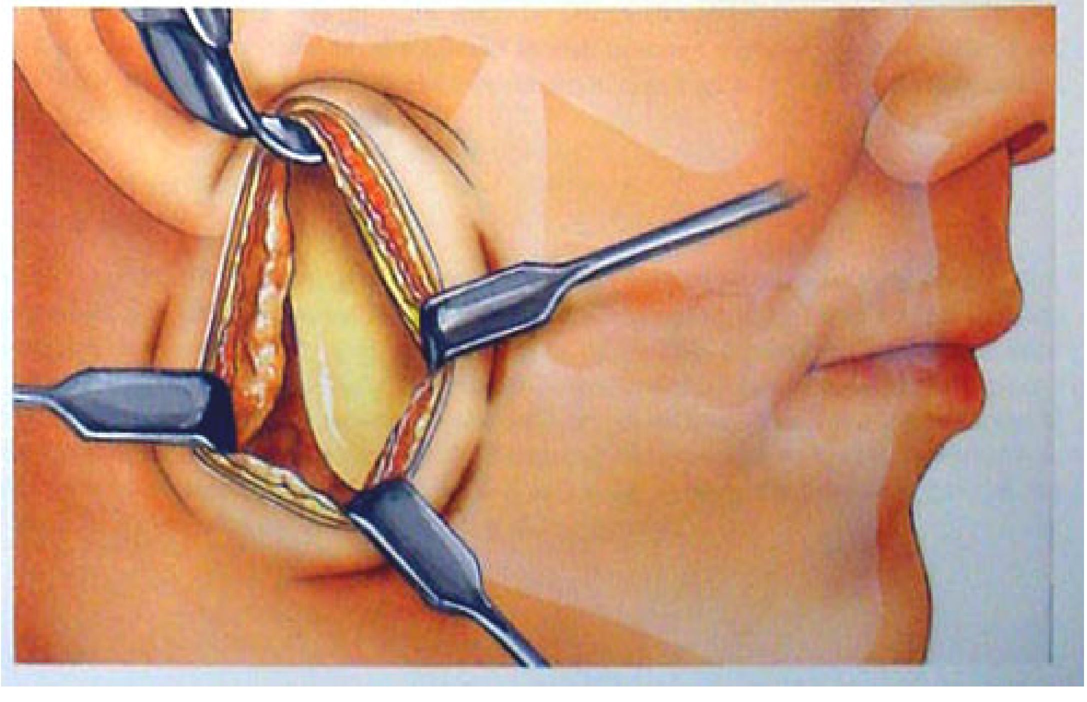
SECTION

V

TRANSFACIAL APPROACHES TO THE MANDIBLE

The mandible can be exposed by surgical approaches using incisions placed on the skin of the face. The position of the incision and anatomy vary according to the region of the mandible approached. Because there are almost no anatomic hazards to transfacial exposure of the mandibular symphysis, this approach is not presented. The focus of this section is on the submandibular, retromandibular, and rhytidectomy approaches. All are used to expose the posterior regions of the mandible and all must negotiate important anatomic structures. Approaches to the temporomandibular joint are presented in Section VI.





9 Submandibular Approach

One of the most useful approaches to the mandibular ramus and posterior body region, the submandibular approach, occasionally referred to as the Risdon approach, may be used for access to a myriad of mandibular osteotomies, angle/body fractures, and even condylar fractures and temporomandibular joint (TMJ) ankylosis. Descriptions of the approach differ on some points, but all have in common that the incision is made below the inferior border of the mandible.

SURGICAL ANATOMY

Marginal Mandibular Branch of the Facial Nerve

After the facial nerve divides into temporofacial and cervicofacial divisions, the marginal mandibular branch takes origin and extends anteriorly and inferiorly within the substance of the parotid gland. The marginal mandibular branch or branches, which supply motor fibers to the facial muscles in the lower lip and chin, represent the most important anatomic hazard when performing the submandibular approach to the mandible. Studies have shown that the nerve passes below the inferior border of the mandible in a significant minority of cases (see Fig. 9-1). In Dingman and Grabb's classic dissection of 100 fascial halves, the marginal mandibular branch was as much as 1 cm below the inferior border in 19% of cases (1). Anterior to the point where the nerve crossed the facial artery, all dissections displayed the nerve above the inferior border of the mandible.

Ziarah and Atkinson (2) found an even higher number of cases in which the marginal mandibular branch passed below the inferior border. In 53% of 76 facial halves, they found the marginal mandibular branch below the inferior border reaching the facial vessels, and in 6%, the nerve continued for a farther distance of as much as 1,5 cm before turning upward and crossing the mandible. The farthest distance between a marginal mandibular branch and the inferior border of the mandible was 1,2 cm. In view of these findings, most surgeons recommend that the incision and deeper dissection be at least 1,5 cm below the inferior border of the mandible.

Another important finding in the study by Dingman and Grabb (1) was that only 21% of cases had a single marginal mandibular branch between the angle of the mandible and the facial vessels (Fig. 9-2); 67% had two branches (see Fig. 9-1), 9% had three branches, and 3% had four.

Facial Artery

After its origin from the external carotid, the facial artery follows a cervical course, during which it is carried upward medial to the mandible and in fairly close contact with the pharynx. It runs superiorly, deep to the posterior belly of the digastric and stylohyoid muscles, and then crosses above them to descend on the medial surface of the mandible, grooving or passing through the submandibular salivary gland as it rounds the lower border of the mandible. It appears an the external surface of the mandible around the anterior border of the masseter muscle (see Fig. 9-1 and 9-2). Above the inferior border of the mandible, it lies anterior to the facial vein and is tortuous.

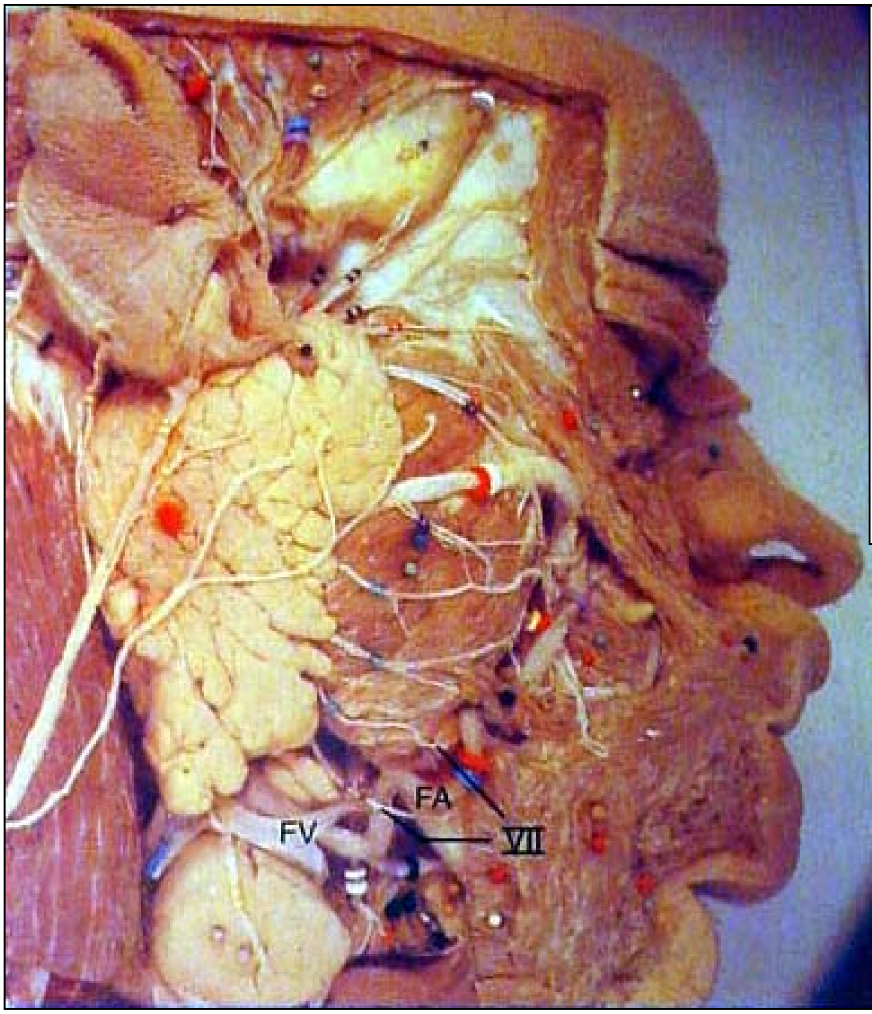


Figure 9- 1 Anatomic dissection of the lateral face showing the relationship of the parotid gland, submandibular gland, facial artery (FA) and vein (FV), and marginal mandibular branches of the facial nerve (VII). Two marginal mandibular branches are present are present in this specimen, one below the inferior border of the mandible.

Facial Vein

The facial (anterior facial) vein if the primary venous outlet of the face. It begins as the angular vein, in the angle between the nose and eye. It generally courses with the facial artery above the level of the inferior mandibular border, but it is posterior to the artery (see Figs. 9-1 and 9-2). Unlike the facial artery, the facial vein runs across the surface of the submandibular gland to end in the internal jugular vein.

TECHNIQUE

Step 1. Preparation and Draping

Pertinent landmarks useful during dissection should be exposed throughout the procedure. For operations involving the mandibular ramus/angle, the corner of the mouth and lower lip should be exposed within the surgical field anteriorly and the ear, or at least the ear lobe, posteriorly. These landmarks helps the surgeon to mentally visualize the course of the facial nerve and to see whether the lip moves if stimulated.

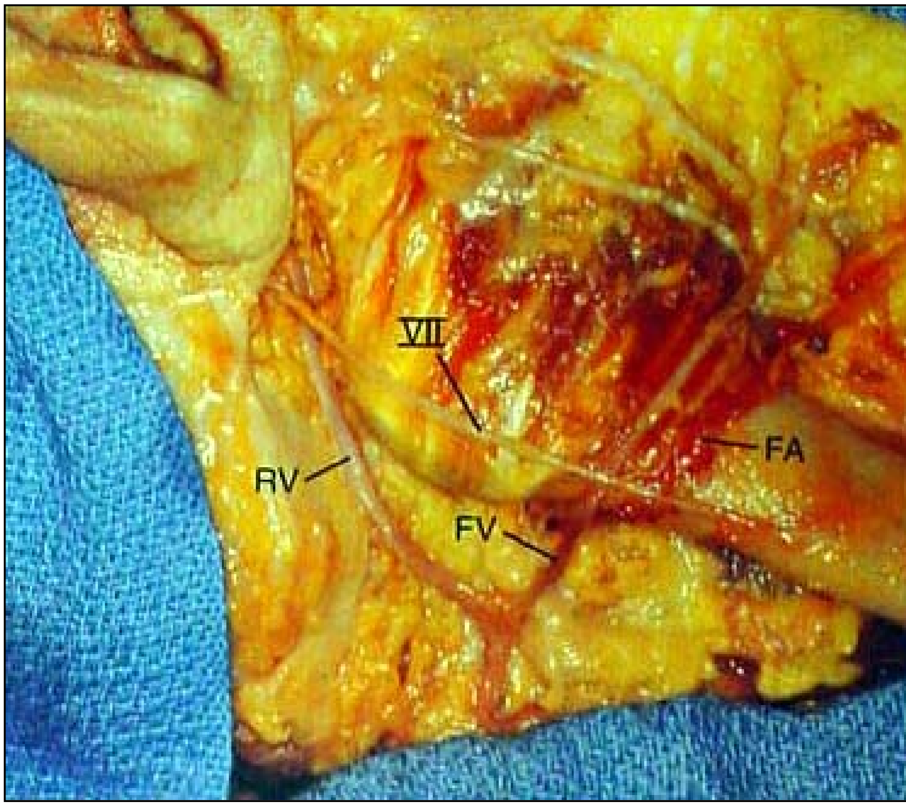


Figure 9- 2 Anatomic dissection of the lateral face showing the relationship of the submandibular gland, facial artery (FA) and vein (FV), retromandibular vein (RV), and marginal mandibular branch of the facial nerve (VII) (parotid gland has been removed). Only one marginal mandibular branch is present in this specimen and it is superior to the inferior border of the mandible.

Step 2. Marking the Incision and Vasoconstriction

The skin is marked before injection of a vasoconstrictor. The incision is 1,5 to 2 cm inferior to the mandible. Some surgeons prefer to parallel the inferior border of the mandible; others place the incision in or parallel to a neck crease (Fig. 9-3). Incisions made parallel to the inferior border of the mandible may be unobtrusive in some patient; however, extensions of this incision may be noticeable unless hidden in the submandibular shadow. A less conspicuous scar result when the incision is made in or parallel to a skin crease. It should be noted that skin creases below the mandible do not parallel the inferior border of the mandible but run obliquely, posterosuperiorly to anteroinferiorly. Thus, the further anterior the surgeon makes an incision in or parallel to a skin crease, the greater the distance to dissect to reach the inferior border of the mandible. Both incisions can be extended posteriorly to the mastoid region if necessary.

Mandibular fractures that shorten the vertical height of the ramus by their displacement (i.e., condylar fractures in patients without posterior teeth or those not placed into maxillomandibular fixation) will cause the angle of the mandible to be more superior than it would be following reduction and fixation. Therefore, the incision should be 1,5 to 2 cm inferior to the *anticipated* location of the inferior border.

The incision is located along a suitable skin crease in whatever anteroposterior position needed for mandibular exposure. For a fracture that extends toward the gonial angle, the incision should begin behind and above the gonial angle, extending downward and forward until it is in front of the gonial angle. For fractures located more anterior than the gonial angle, the incision does not have to extend behind and/or above the gonial angle, but may extend farther anteriorly.

Vasoconstrictors with local anesthesia injected subcutaneously to aid in hemostasis should not be placed deep to the platysma muscle because the marginal mandibular branch of the facial nerve may be rendered nonconductive, making electrical testing impossible. Alternatively, a vasoconstrictor without local anesthesia can be used both superficially and deeply to promote hemostasis.

Step 3. Skin Incision

The initial incision is carried through skin and subcutaneous tissues to the level of the platysma muscle (Fig. 9-4). The skin is undermined with scissor dissection in all directions to facilitate closure. The superior portion of the incision is undermined approximately 1 cm; the inferior portion is undermined approximately 2 cm or more. The ends of the incision can be undermined extensively to allow retraction of the skin anteriorly or posteriorly to increase the amount of mandibular exposure. In this manner, a shorter skin incision can provide a great amount of exposure. Hemostasis is then achieved with eletrocoagulation of bleeding subdermal vessels.

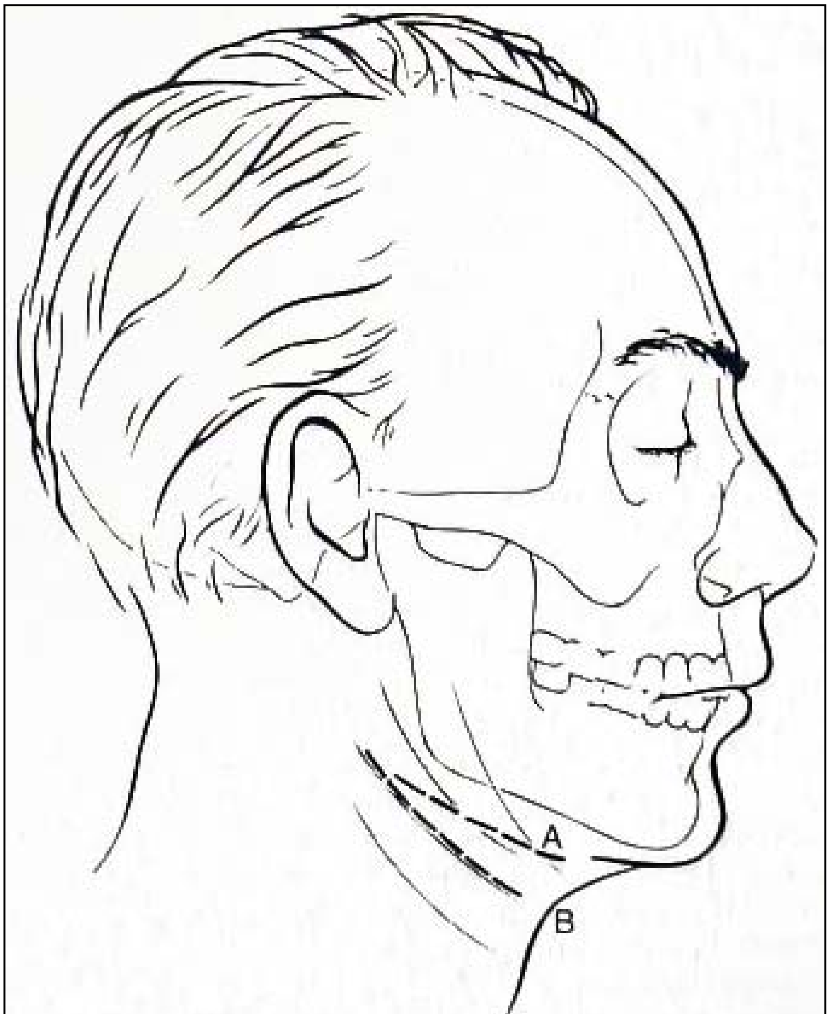


Figure 9- 3 Two locations of submandibular incisions. Incision A parallels the inferior border of the mandible. Incision B parallels or is within the resulting skin tension lines. Incision B makes a less conspicuous scar in most patients.

Step 4. Incising the Platysma Muscle

Retraction of the skin edges reveals the underlying platysma muscle, the fibers of which run superoinferiorly. Division of the fibers can be performed sharply, although a more controlled method is to dissect through the platysma muscle at one end of the skin incision with the tip of a hemostat or Metzenbaum scissor. After undermining the platysma muscle over the white superficial layer of deep cervical fascia, the tips of the instrument are pushed back through the platysma muscle at the other end of the incision. With the instrument deep to the platysma muscle, a scalpel is used to incise the muscle from one end of the skin incision to the other (Fig. 9-5). The anterior

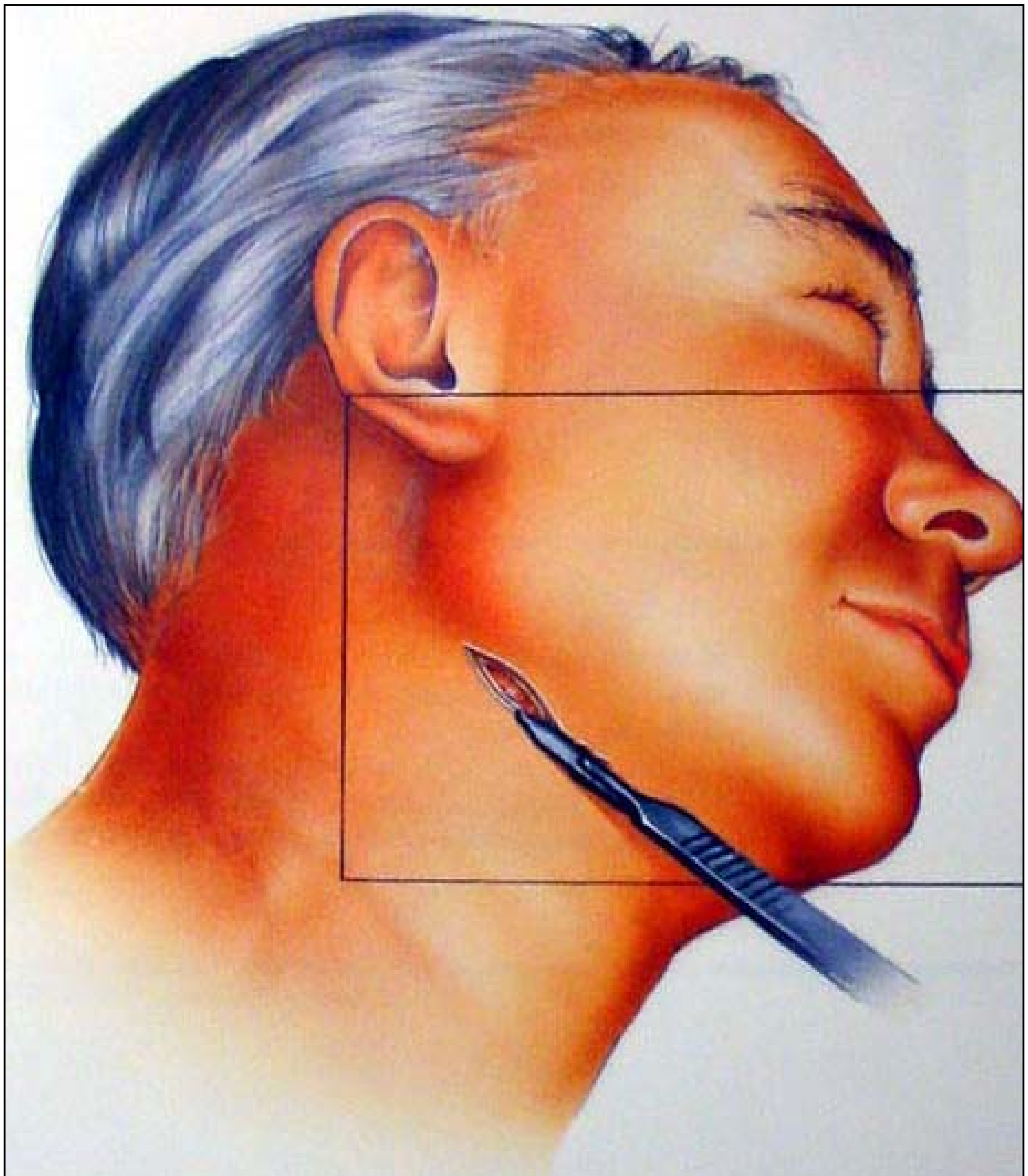


Figure 9- 4 Incision through skin and subcutaneous tissue to the level of the platysma muscle. The incision parallels the lines of minimal tension in the cervical area. The incision does not parallel the inferior border of the mandible but courses inferiorly as it extends anteriorly

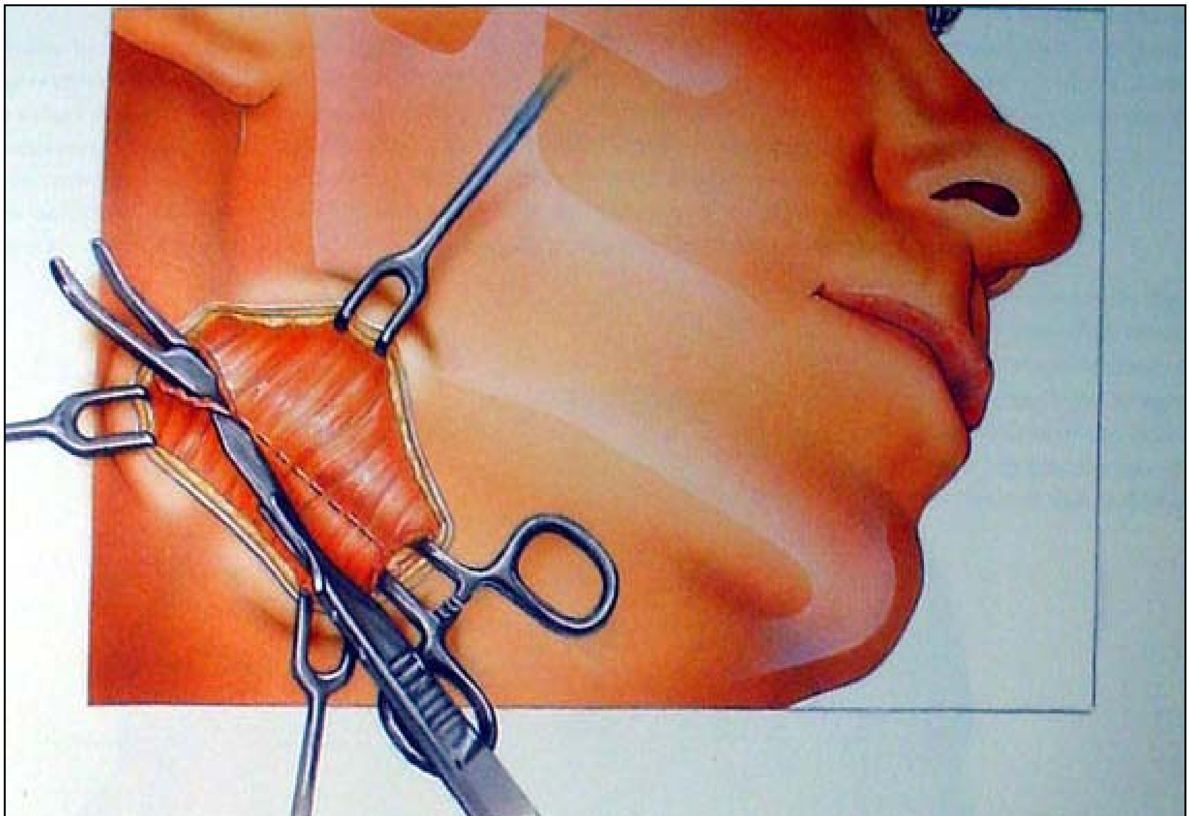


Figure 9- 5 Sharp dissection through the platysma muscle that has been undermined with a hemostat.

and posterior skin edges can be retracted sequentially to allow a greater length of platysma muscle division than the length of the skin incision.

The platysma muscle passively contracts once it is divided, exposing the underlying superficial layer of deep cervical fascia. The submandibular salivary gland can also be visualized through the fascia, which helps form its capsule.

Step 5. Dissection to the Pterygomasseteric Muscular Sling

Dissection through the superficial layer of deep cervical fascia is the step that requires the most care because of the anatomic structures with which it is associated. The facial vein and artery are usually encountered when approaching the area of the premasseteric notch of the mandible, as may the marginal mandibular branch of the facial nerve (Fig. 9-6). The facial vessels can be isolated, clamped, and ligated if they are in the way of the area of interest. When approaching the mandible posterior to the premasseteric notch, these vascular structures generally are not encountered; if they are easily retracted anteriorly. The marginal mandibular branch, however, occasionally is inferior to the mandible posterior to the premasseteric notch, so care must be taken.

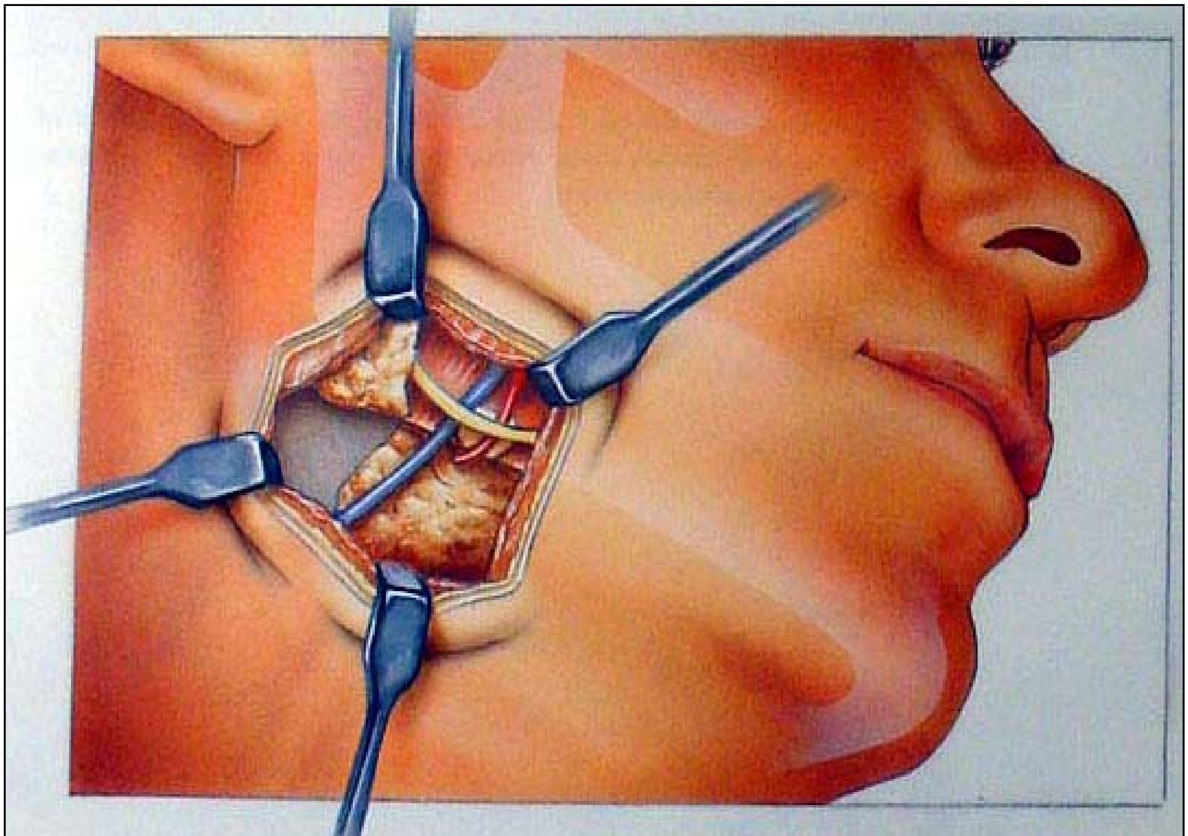


Figure 9- 6 Relationship of the facial artery and vein, the marginal mandibular branch of the facial nerve, and the submandibular (premasseteric) lymph node to the inferior border of the mandible and masseter muscle.

Dissection through the superficial layer of deep cervical fascia is accomplished by nicking it with a scalpel and bluntly undermining with a hemostat or Metzenbaum scissors. The level of the incision and undermining of the fascia should be at least 1,5 cm inferior to the mandible to help protect the marginal mandibular branch of the facial nerve. Thus, dissection *through* the fascia *at the level of the initial skin incision* is performed, followed by dissection superiorly to the level of the periosteum of the mandible. The capsule of the submandibular salivary gland if often entered during this dissection, and the gland is retracted inferiorly (Fig. 9-7). A consistent submandibular lymph node (node of Stahr) is usually encountered in the area of the premasseteric notch and can be retracted superiorly or inferiorly. Its presence should alert the surgeon to the facial artery just anterior to the node, deep to the superficial layer of the deep cervical fascia. The marginal mandibular branch of the facial nerve may be located close by, within or just deep to the superficial layer of deep cervical fascia, passing superficial to the facial vein and artery. An electrical nerve stimulator can be used to identify the nerve so that it can be retracted superiorly. In many instances, however, this facial nerve branch is superior to the area of dissection and is not encountered.

Dissection continues until the only tissue remaining on the inferior border of the mandible is the periosteum (anterior to the premasseteric notch) or the pterygomasseteric sling (posterior to the premasseteric notch).

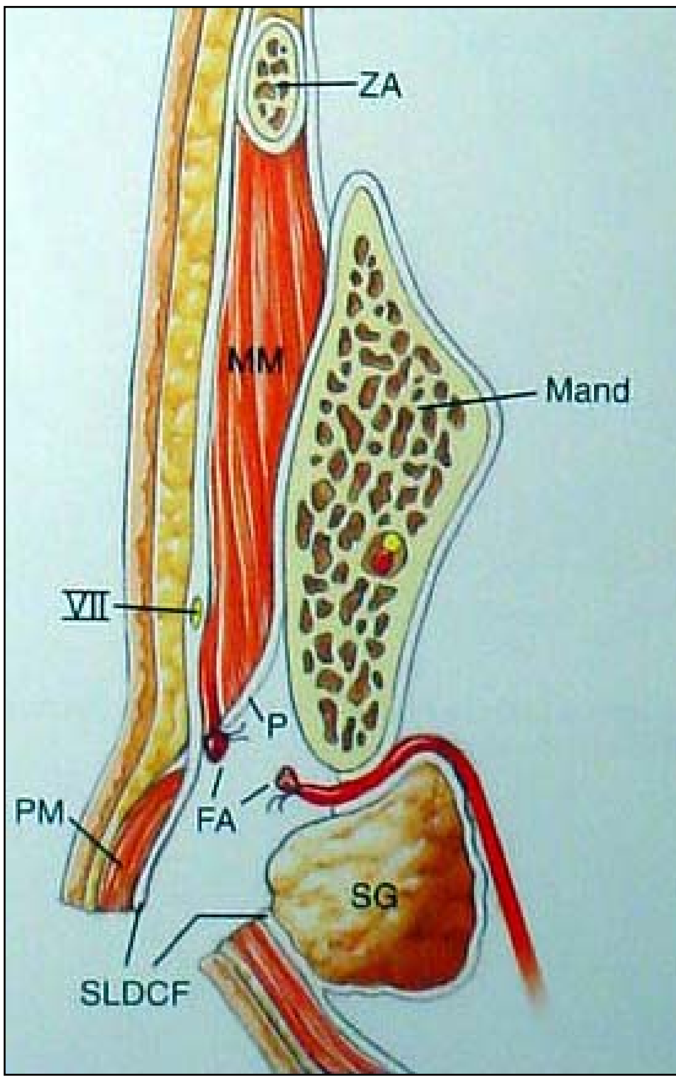


Figure 9- 7 Coronal illustration of the path of dissection. The initial dissection is through the platysma muscle (PM) to the superficial layer of deep cervical fascia (SLDCF), then through it in the area of the submandibular gland (SG) to the periosteum (P) of the mandible (Mand), which is incised at the inferior border. FA= facial artery; MM = masseter muscle; ZA = zygomatic arch; VII = marginal mandibular branch of the facial nerve.

Step 6. Division of the Pterygomasseteric Sling and Submasseteric Dissection

With retraction of the dissected tissue superiorly and placement of a broad ribbon retractor just below the inferior border of the mandible to retract the submandibular tissues medially, the inferior border of the mandible is visualized. The pterygomasseteric sling is sharply incised with a scalpel along the inferior border, the most avascular portion of the sling (Fig. 9-8). Incisions on the lateral surface of the mandible into the masseter muscle often produce bothersome hemorrhage. Increased exposure of the mandible is made possible by sequentially retracting the overlying tissues anteriorly and posteriorly, permitting more exposure of the inferior border for incision.

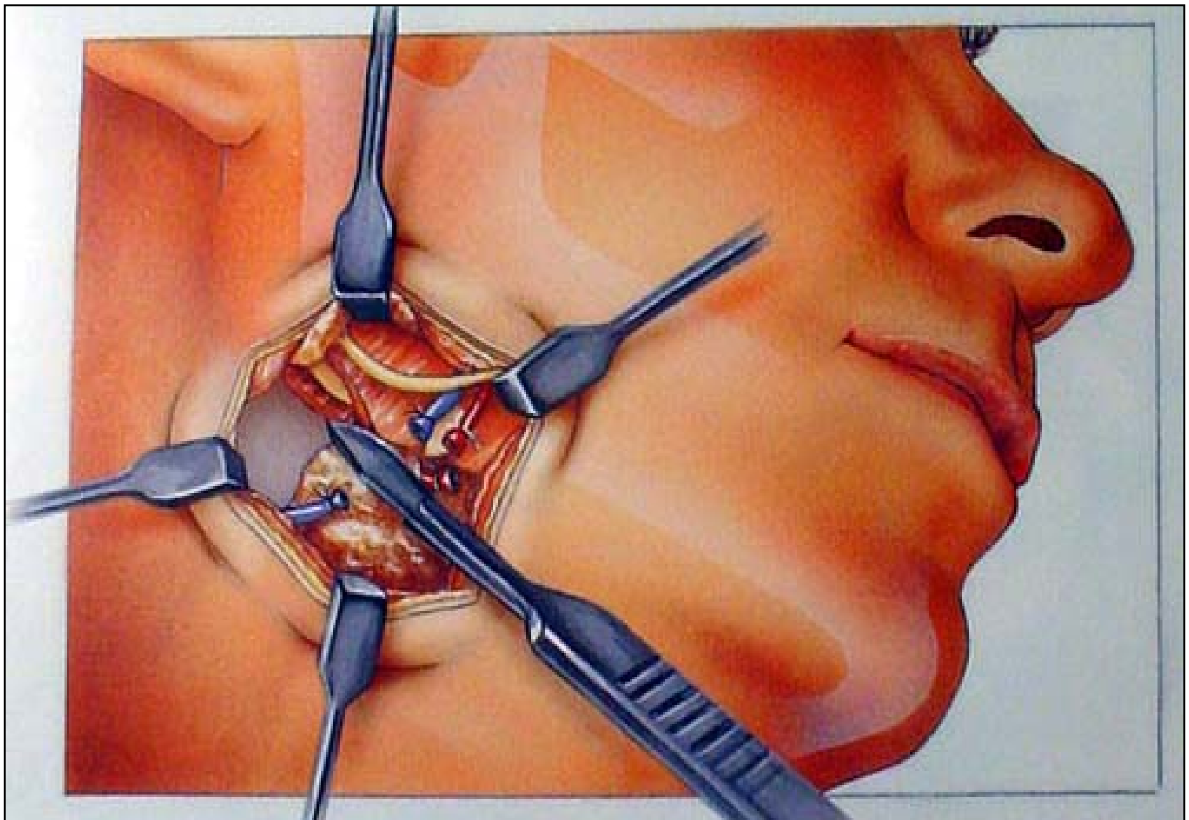


Figure 9- 8 Incision through the petygomasseteric sling after retraction of vital structures. the incision should be at the inferior border of the mandible because it is the most avascular area in which the masseter and medial pterygoid muscles join.

The sharp end of a periosteal elevator is drawn along the length of the periosteal incision to begin stripping the masseter muscle from the lateral ramus. Care is taken to keep the elevator in intimate contact with the bone or shredding of the masseter results, causing bleeding and making retraction of the shredded tissue difficult. The entire lateral surface of the mandibular ramus (including the coronoid process) and the body can be exposed to the level of the TMJ capsule (Fig. 9-9), being sure to avoid perforating into the oral cavity along the retromolar area if this is not desired. The only tissue separating the oral cavity from the dissection once the buccinator muscle has been stripped from the retromolar area is the oral mucosa. Retraction of the masseter muscle is facilitated by inserting a suitable retractor into the sigmoid notch (channel retractor, sigmoid notch retractor)(Fig.9-10).

More anterior in the mandibular body, care is needed to avoid damage to the mental neurovascular bundle, which exits the mental foramen, close to the apices of the bicuspid teeth.

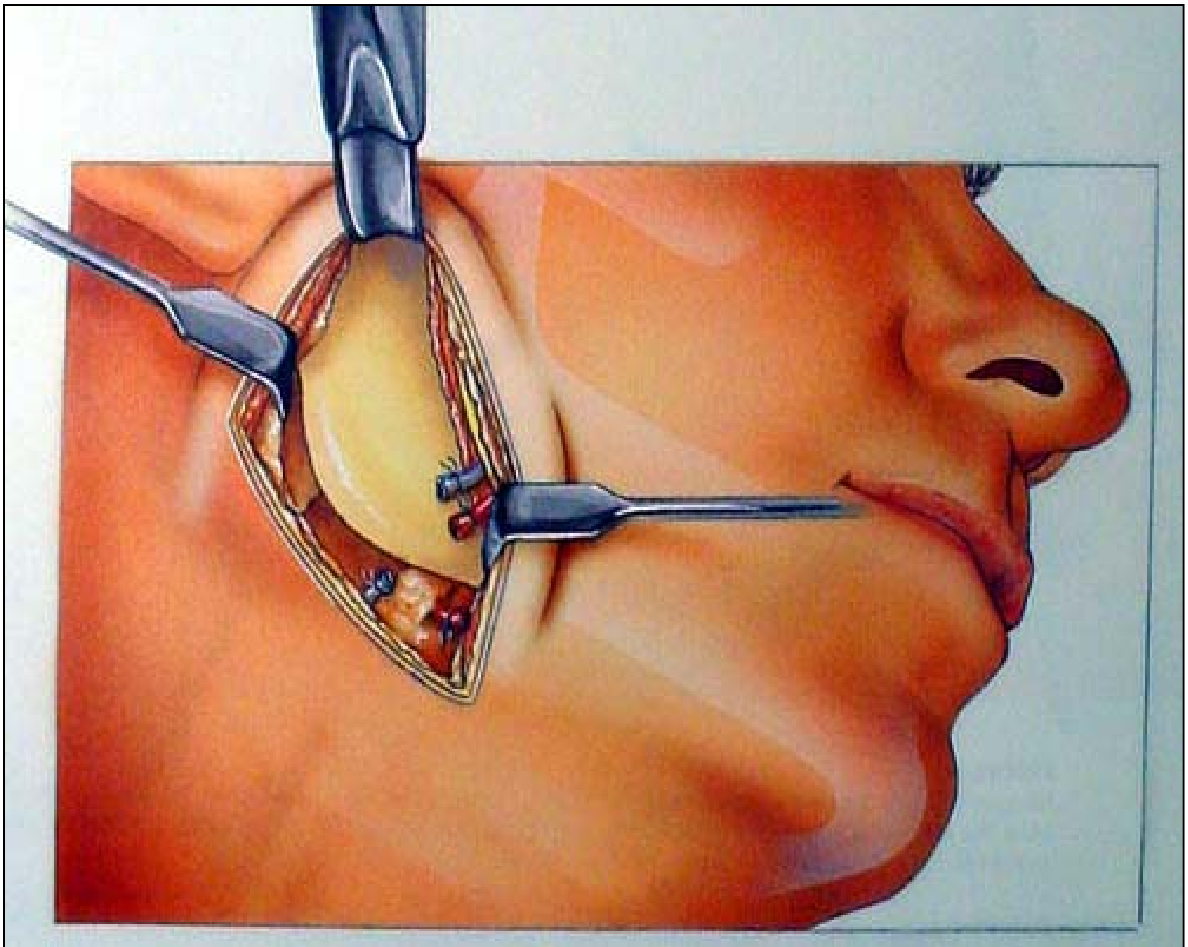


Figure 9- 9 Amount of exposure obtained with the submandibular approach. The channel retractor is placed into the sigmoid notch, elevating the masseter, parotid, and superficial tissues. Exposure more anteriorly is accomplished by retraction in that direction.

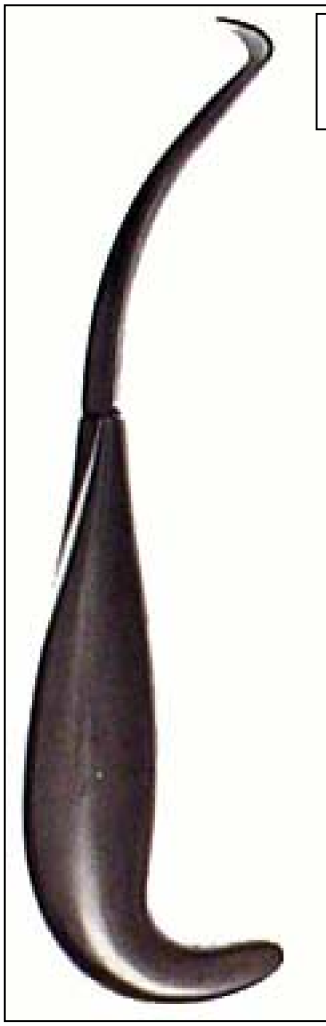


Figure 9- 10 Sigmoid retractor. The curved flange inserts into the sigmoid notch, retracting the masseter muscle.

Step 7. Closure

The masseter and medial pterygoid muscle are sutured together with interrupted resorbable sutures (Fig. 9-11). It is often difficult to pass the suture needle through the medial pterygoid muscle because it is thin an the inferior border of the mandible. To facilitate closure, it is possible to strip the edge of the muscle for easier passage of the needle.

The superficial layer of deep cervical fascia does not require definitive suturing. The platysma muscle may be closed with a running resorbable suture (Fig. 9-11). Subcutaneous resorbable sutures are placed, followed by skin sutures.

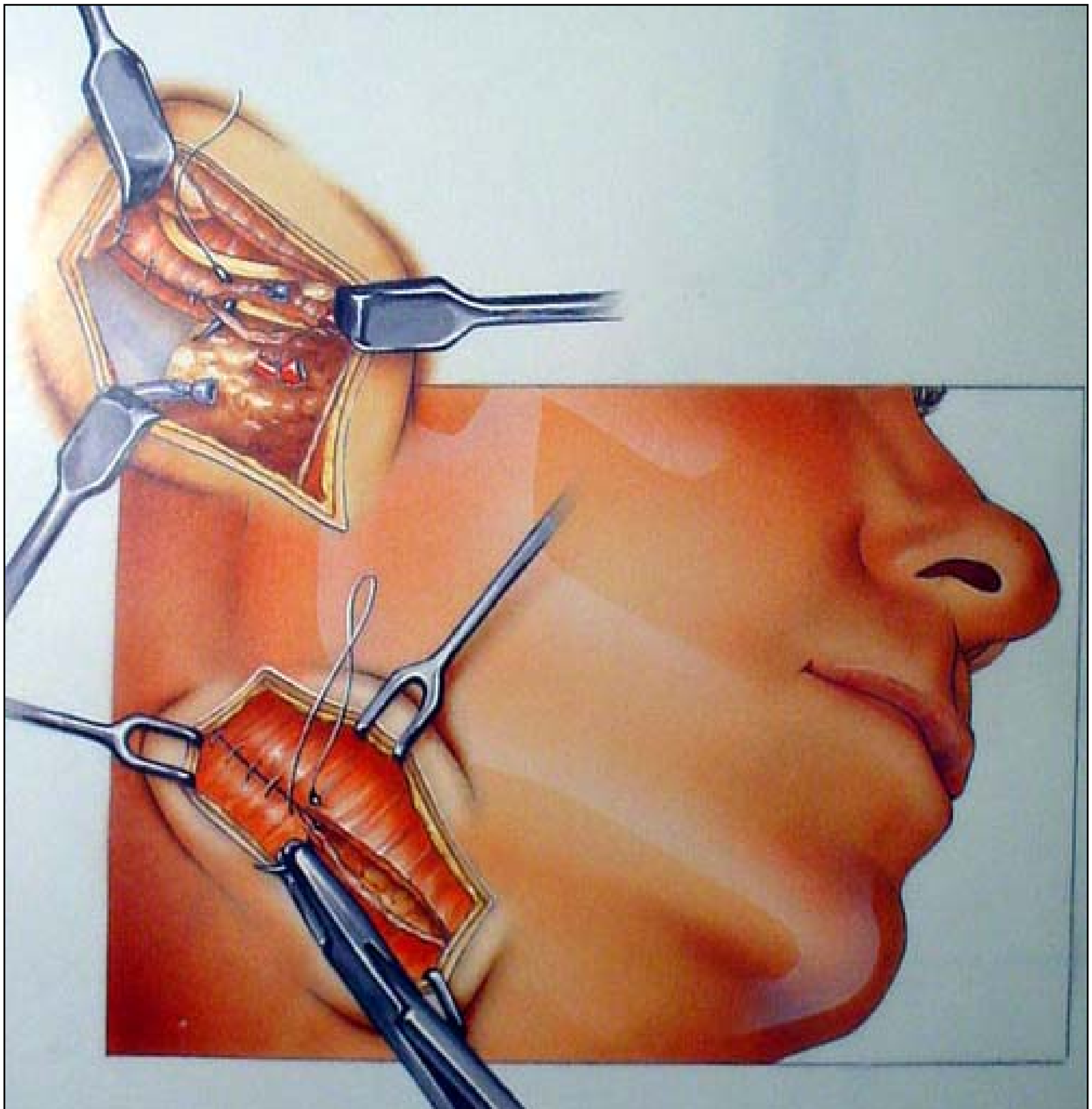


Figure 9- 11 Closure of the pterygomasseteric sling (insert) and platysma. The pterygomasseteric sling is closed with resorbable interrupted suture. The platysma can be closed with a running resorbable suture, taking care to avoid damaging the underlying blood vessels and the seventh nerve.

EXTENDED SUBMANDIBULAR APPROACHES TO THE INFERIOR BORDER OF THE MANDIBLE

Should more exposure of the mandible become necessary, the surgeon has several choices. For increased ipsilateral exposure, the submandibular incision can be extended posteriorly toward the mastoid region, and anteriorly in an arcing manner toward the submental region (Fig. 9-12). Once the incision leaves the direction of the resting skin tension lines, however, the resultant scar will be more obvious.

To eliminate some of the undesirable scarring that may accompany the change in direction of the incision toward the submental area, one can step the anterior portion of the incision (Fig. 9-13) (3).

Surgical splitting of the lower lip is another maneuver occasionally used in combination with incisions in the submandibular area to increase exposure to one side of the mandible. It is possible to divide the lower lip in several ways. Each method uses the principle of breaking up the incision line to minimize scar contracture during healing (Figs. 9-14 and 9-15).

For complete bilateral exposure of the mandible, one can use an "apron" flap with or without lip splitting. Bilateral submandibular incisions are extended into the neck and then are connected. The incision may course somewhat toward the submental region or be kept low in the neck, depending on the surgical requirements (Fig. 9-16).

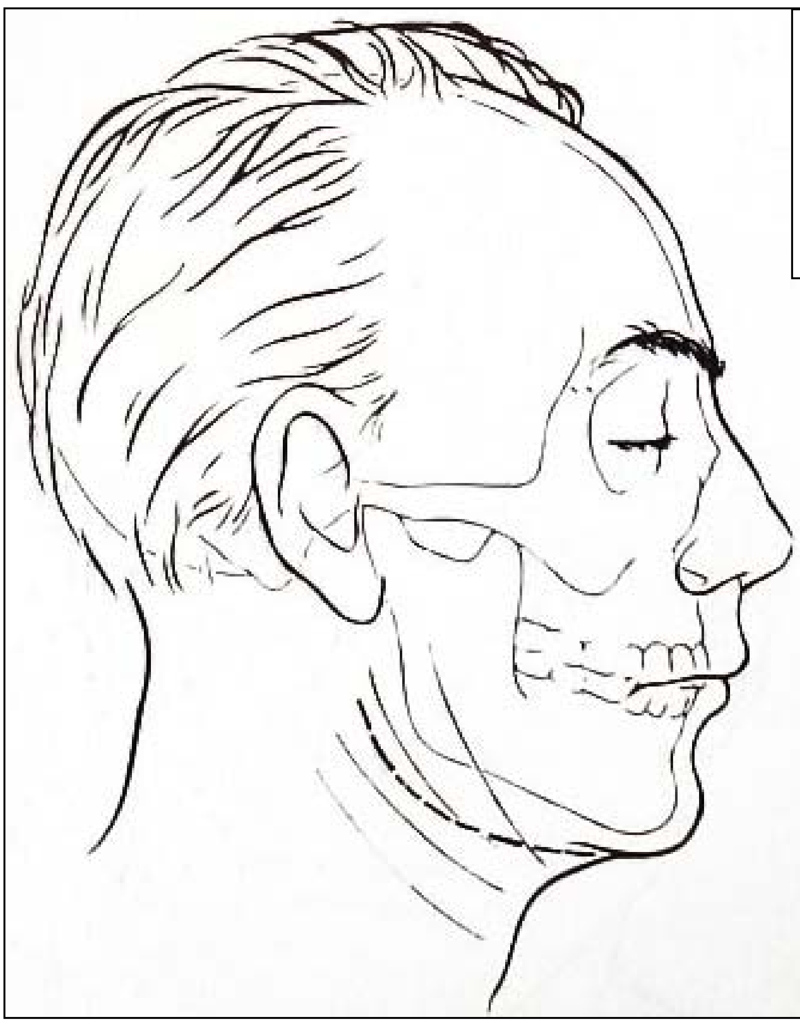


Figure 9- 12 Extension of the submandibular incision posteriorly toward the mastoid region and anteriorly toward the submental region. Note that the incision leaves the resting skin tension lines anteriorly.

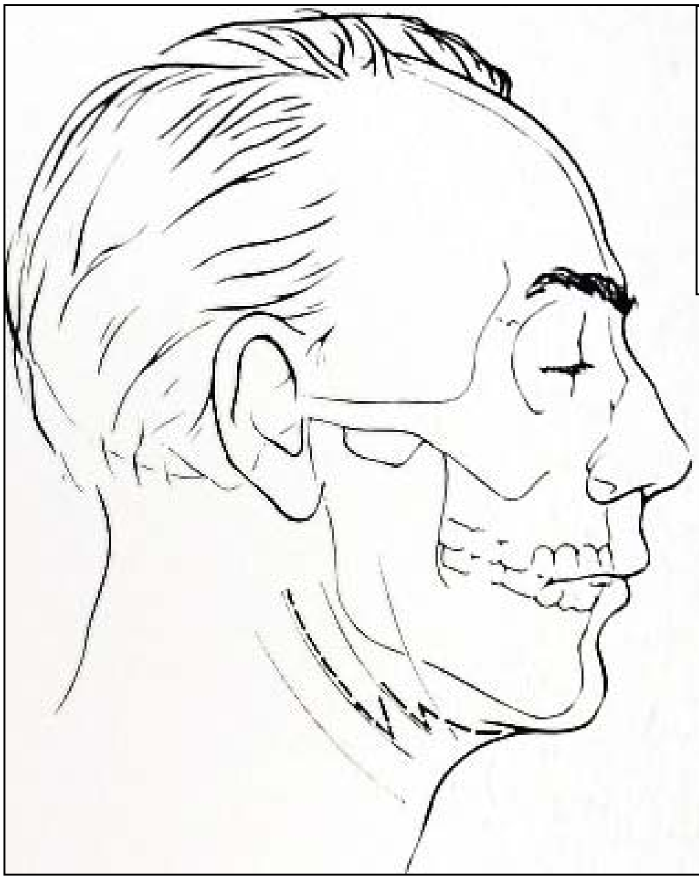
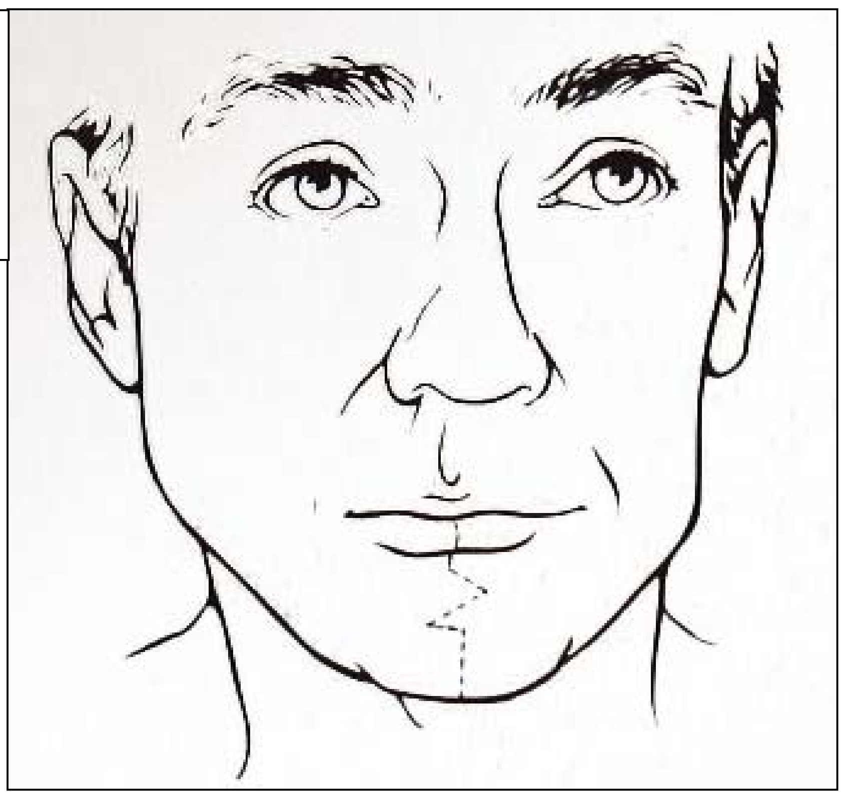


Figure 9- 14 Extension of the submandibular incision posteriorly toward the mastoid region and anteriorly toward the submental region in a "stepped" manner. The longer arms of the step should be kept close or parallel to the resting skin tension lines.

Figure 9- 13 One technique of splitting the lower lip in the midline. This incision can be connected to submandibular incisions on either side.



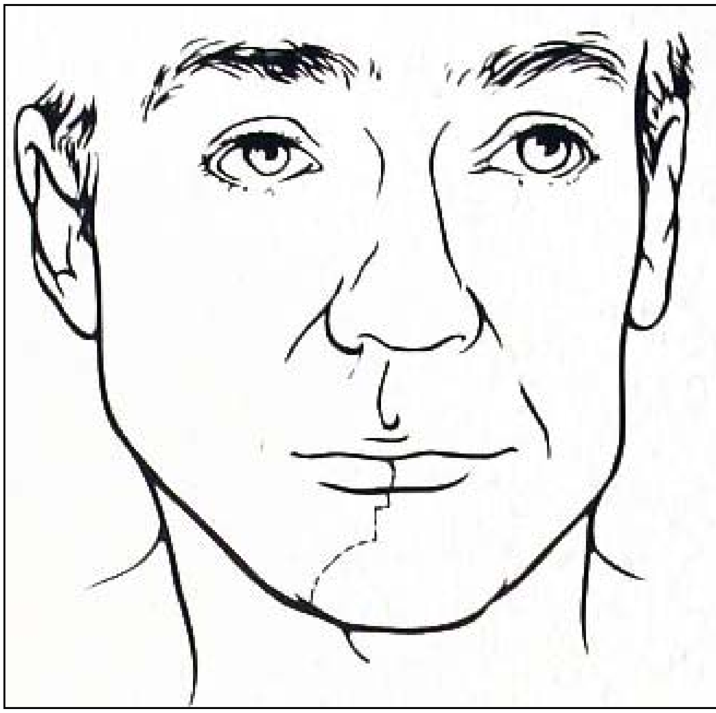


Figure 9- 15 A technique of splitting the lip following the mentolabial crease. This technique is used in conjunction with a contralateral submandibular incision to increase exposure of that side of the mandible.

Figure 9- 16 Bilateral submandibular incisions connected in the midline for complete bilateral exposure of mandible.

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2. Ziarah HA, Atkinson ME: The surgical anatomy of the cervical distribution of the facial nerve. Br J Oral Maxillofac Surg *19*:159, 1981.
3. Zide M, Epker BN: An alternate elective neck incision. J Oral Maxillofac Surg *51*:1071, 1993.

10 Retromandibular Approach

The retromandibular approach exposes the entire ramus from behind the posterior border. It may therefore be useful for procedures involving the area on or near the condylar neck/head, or ramus itself. The distance from the skin incision to the area of interest is reduced in comparison to that of the submandibular approach.

SURGICAL ANATOMY

Facial Nerve

The main trunk of the facial nerve emerges from the skull base at the stylomastoid foramen. It lies medial, deep, and slightly anterior to the middle of the mastoid process at the lower end of the tympanomastoid fissure. After giving off the posterior auricular and branches to the posterior digastric and stylomastoid muscles, it passes obliquely inferiorly and laterally into the substance of the parotid gland. The length of the facial nerve trunk that is visible to the surgeon is about 1,3 cm. It divides into the temporofacial and cervicofacial divisions at a point inferior to the lowest part of the bony external auditory meatus (Fig. 10-1). The average distance from the lowest point on the external bony auditory meatus to the bifurcation of the facial nerve is 2,3 cm (S.D. 0,28 cm) (1). Posterior to the parotid gland, the nerve trunk is at least 2 cm deep to the surface of the skin. The two divisions proceeds forward in the substance of the parotid gland and divide into their terminal branches (Fig. 10-2).

The marginal mandibular branch courses obliquely downward and anteriorly. It frequently arises from the main trunk well behind the posterior border of the mandible and crosses the posterior border in the lower one third of the ramus. This positioning leaves a void between the buccal branches and the marginal mandibular branch or branches through which the mandible can be approached safely (Fig. 10-3).

Retromandibular Vein

The retromandibular vein (posterior facial vein) is formed in the upper portion of the parotid gland, deep to the neck of the mandible, by the confluence of the superficial temporal vein and the maxillary vein. Descending just posterior to the ramus of the mandible through the parotid gland, or folded into its deep aspect, the vein is lateral to the external carotid artery (see Fig. 10-3). Both vessels are crossed by the facial nerve. Near the apex of the parotid gland, the retromandibular vein gives off an anteriorly descending communication that joins the facial vein just below the angle of the mandible. The retromandibular vein then inclines backward and unites with the posterior auricular vein to form the external jugular vein.

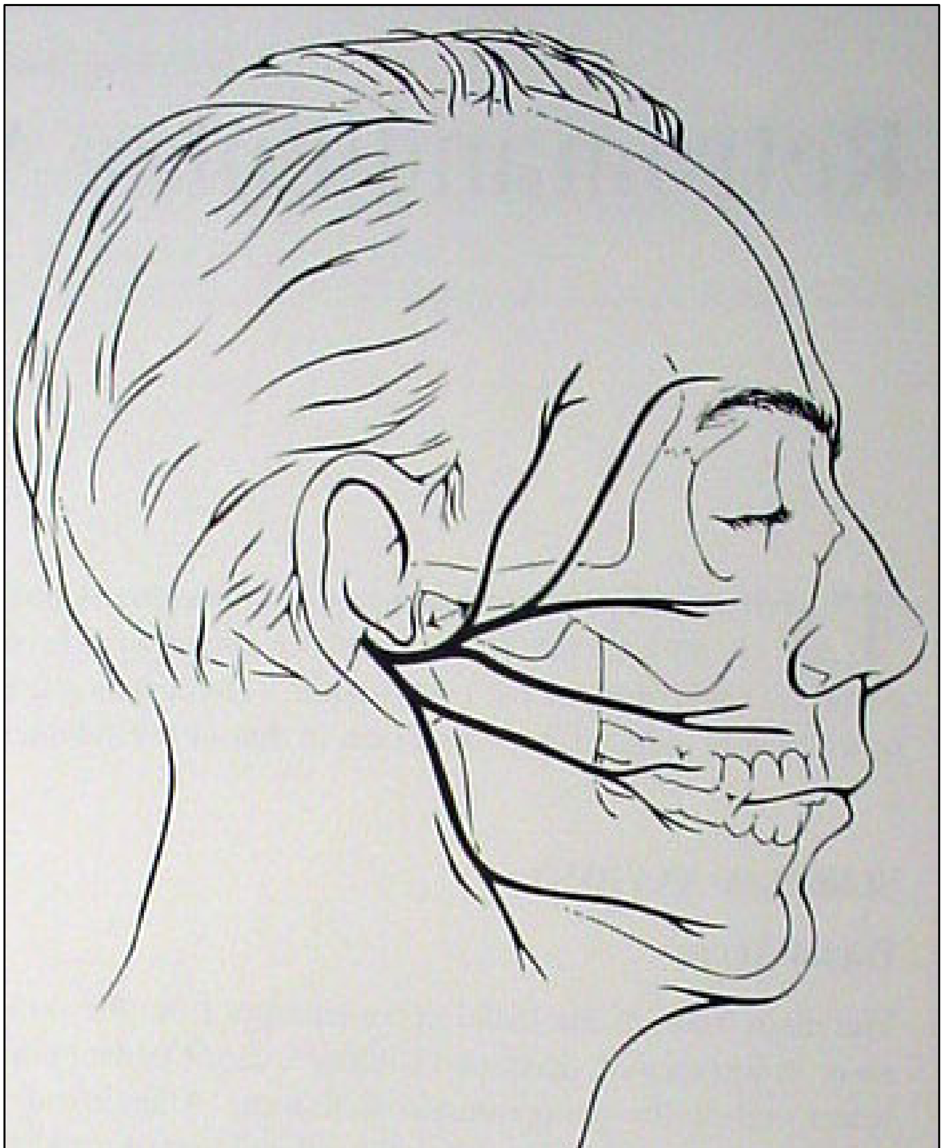

Figure 10- 1 Branching of the extracranial portion of the facial nerve. Only the main branches are shown. Many smaller branches occur in most individuals (see Figure 10-2).

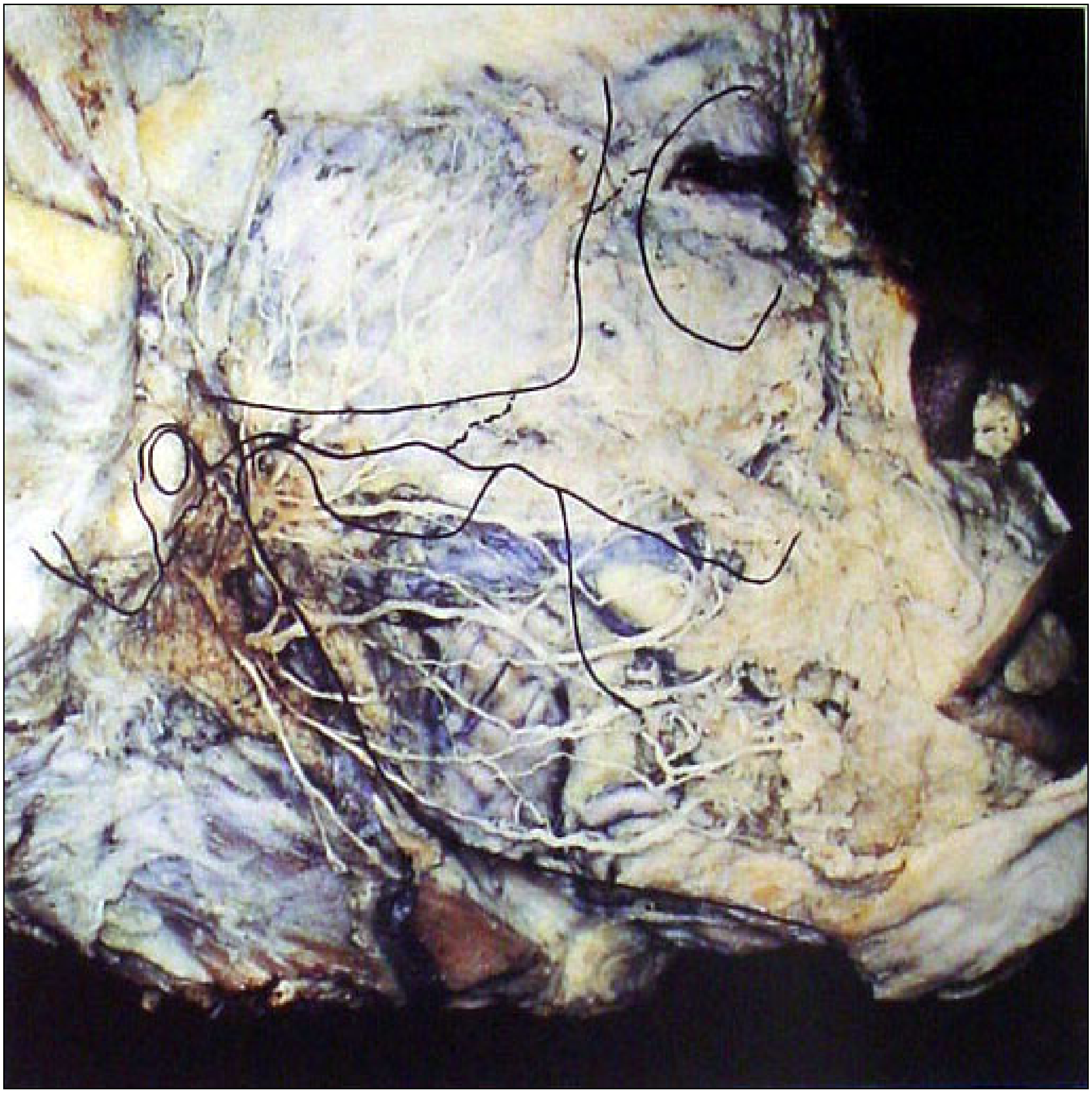

Figure 10-2. Anatomic dissection reveals an extensive branching pattern of the facial nerve (the parotid gland was removed)

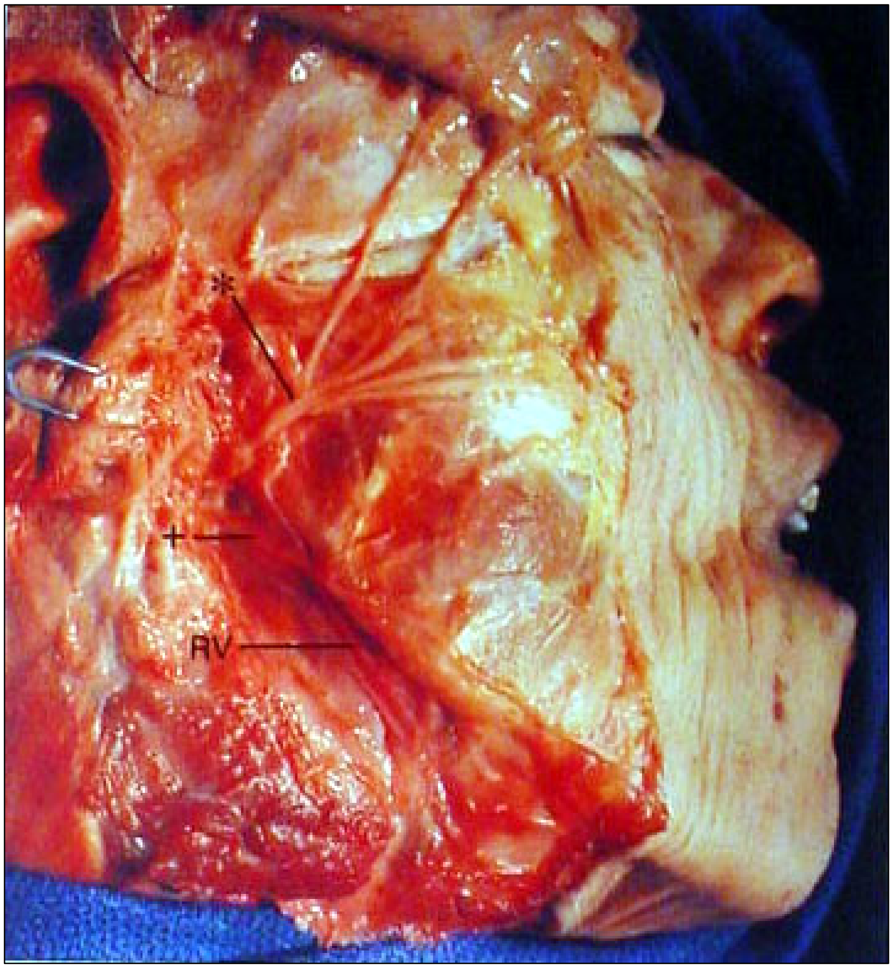

Figure10-3 Anatomic dissection showing the relationship of the retromandibular vein (RV) , and inferior (+) and superior divisions (*) of the VII to the mandible. Note the space between the inferior and superior divisions of VII, through which the posterior border of the mandible can be approached

TECHNIQUE

The retromandibular approach to the mandible varies with surgeons in the position of the skin incision – which also dictates the underlying dissection. Some surgeons advocate placing an incision approximately 2 cm posterior to the ramus. The parotid gland is approached from behind and sharply dissected from the sternocleidomastoid muscle, allowing retraction of the gland superiorly and anteriorly to gain access to the ramus. The theoretic advantage to this approach is that it avoids the branching facial nerve, which is contained within the parotid gland. Unfortunately, the primary advantage of the retromandibular approach, the direct proximity of the skin incision to the mandible, is then lost. An alternate approach, presented here, was described by Hinds (2). The incision is placed at the posterior ramus, just below the earlobe. Dissection to the posterior border of the mandible is direct, traversing the parotid gland and exposing some branches of the facial nerve.

Step 1. Preparation and Draping

Pertinent landmarks should be exposed throughout the procedure, keeping the corner of the mouth and lower lip within the surgical field anteriorly and the entire ear posteriorly. These landmarks orient the surgeon to the course of the facial nerve and allow observation of lip motor function.

Step 2. Marking the Incision and Vasoconstriction

The skin is marked before injection of a vasoconstrictor. The incision for the retromandibular approach begins 0,5 cm below the lobe of the ear and continues inferiorly 3 to 3,5 cm (Fig. 10-4). It is placed just behind the posterior border of the mandible and may or may not extend below the level of the mandibular angle, depending on the amount of exposure needed.

Epinephrine (1:200.000) without a local anesthetic is useful, although routine local anesthetic with a vasoconstrictor may be injected subcutaneously to aid hemostasis at the time of incision. One should not inject local anesthetics deep to the platysma muscle because of the risk of rendering the facial nerve branches nonconductive, making electrical testing impossible.

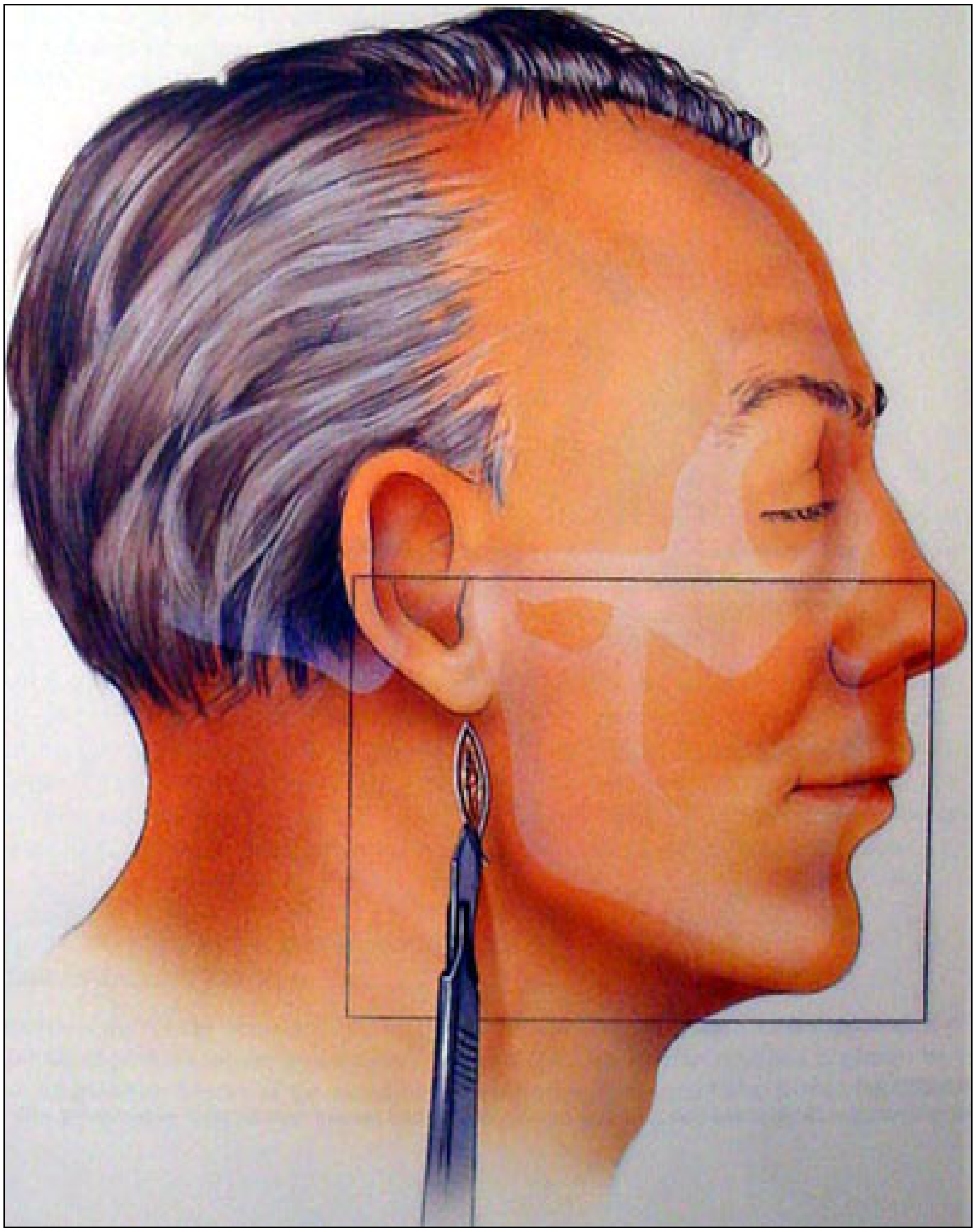

Figure 10-4 Vertical incision just posterior to the mandible through skin and subcutaneous tissue to the depth of the platysma muscle.

Step 3. Skin Incision

The initial incision is carried through skin and subcutaneous tissues to the level of the scant platysma muscle present in this area (see Fig. 10-4). Undermining the skin with scissor dissection in all directions allows ease of the retraction and facilitates closure. Hemostasis is then achieved with electro coagulation of bleeding subdermal vessels.

Step 4. Dissection to the Pterogomasseteric Muscular Sling

After retraction of the skin edges, the scant platysma muscle is sharply incised in the same plane as the skin incision (Fig. 10-5). At this point, the superficial musculoaponeurotic layer (SMAS) and parotid capsule are incised and blunt dissection begins within the gland in an anteromedial direction toward the posterior border of the mandible. A homostat is repeatedly inserted and spread open – parallel to the anticipated direction of the facial nerve branches (Fig. 10-6). The marginal mandibular branch of the facial nerve is often, but not always, encountered during this dissection and may intentionally sought with a nerve stimulator. The cervical branch of the facial nerve may

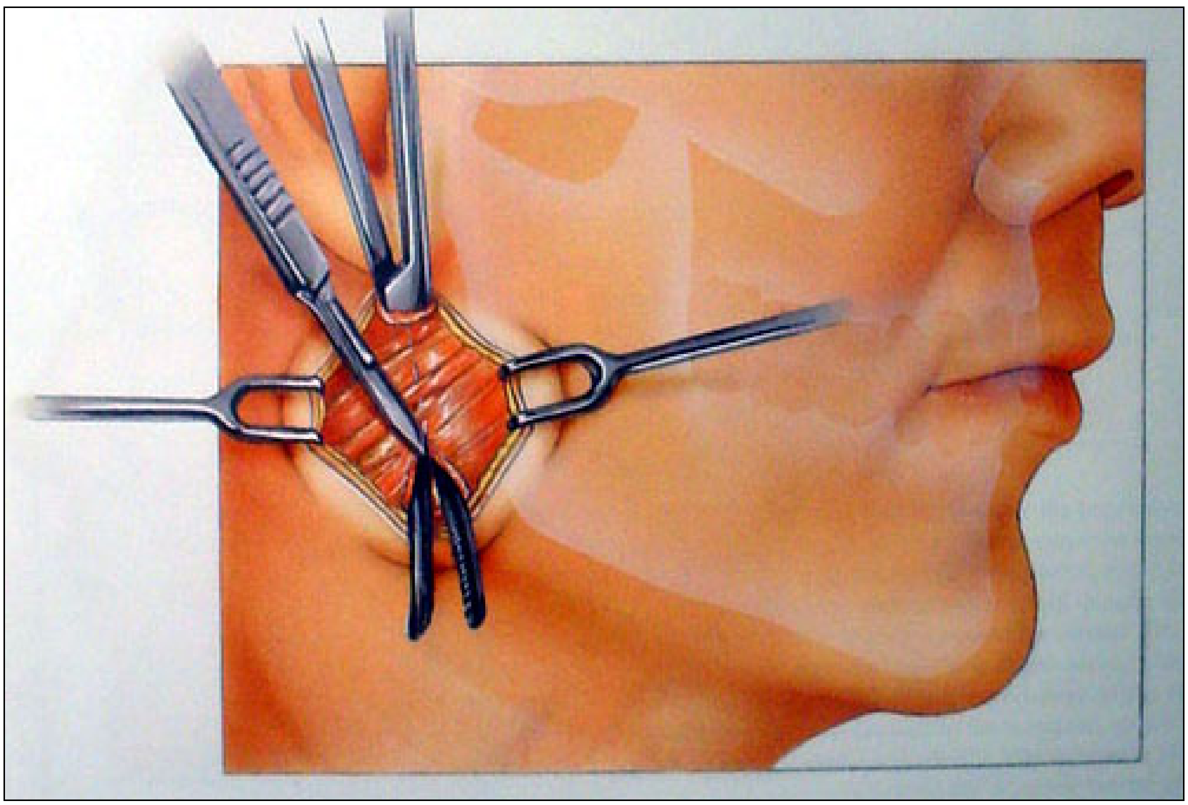

Figure 10-5 Sharp dissection through the thin platysma muscle, SMAS, and parotid capsule after undermining with a hemostat.

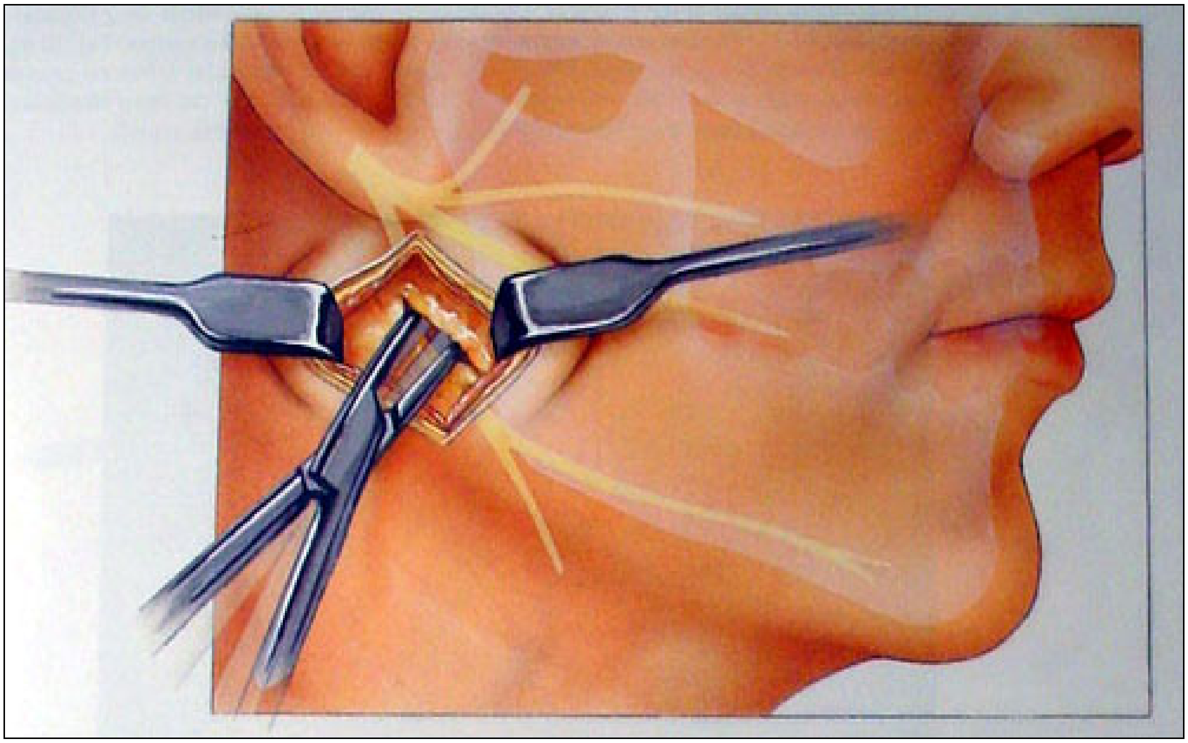

Figure 10-6 Blunt hemostat dissection through the parotid gland, spreading in the direction of the fibers of VII.

Also be encountered, but it is of little consequence as it runs vertically, out of the field. In many instances, the marginal mandibular branch interferes with exposures and may be retracted superiorly depending on its location. A useful adjunct in retracting the marginal mandibular branch involves dissecting it free from surrounding tissues proximally for 1 cm and distally for 1,5 to 2 cm. This simple maneuver determines whether the nerve is better retracted superiorly or inferiorly. Dissection then continues until the only tissue remaining on the posterior border of the mandible is the periosteum of the pterygomasseteric sling (Fig. 10-7). One should also be cognizant of the retromandibular vein, which runs vertically in the same plane of dissection and is commonly exposed along its entire retromandibular course. This vein rarely requires ligation unless it has been inadvertently transected.

Step 5. Division of the Pterygomasseteric Sling and Submasseteric Dissection

After retraction of the dissected tissues anteriorly (the marginal mandibular branch of the facial nerve perhaps under the retractor), a broad retractor such as a ribbon is placed behind the posterior border of the mandible to retract the mandibular tissues medially. The posterior border of the mandible with the overlying pterygomasseteric sling is visualized (Fig. 10-7). The pterygomasseteric sling is sharply incised with a scalpel (Fig. 10-8). The incision begins as far superiorly as is reachable and extends as far inferiorly around the gonial angle as possible. An incision in the posterior portion of the sling bleeds less than an incision placed more laterally through the belly of the masseter muscle.

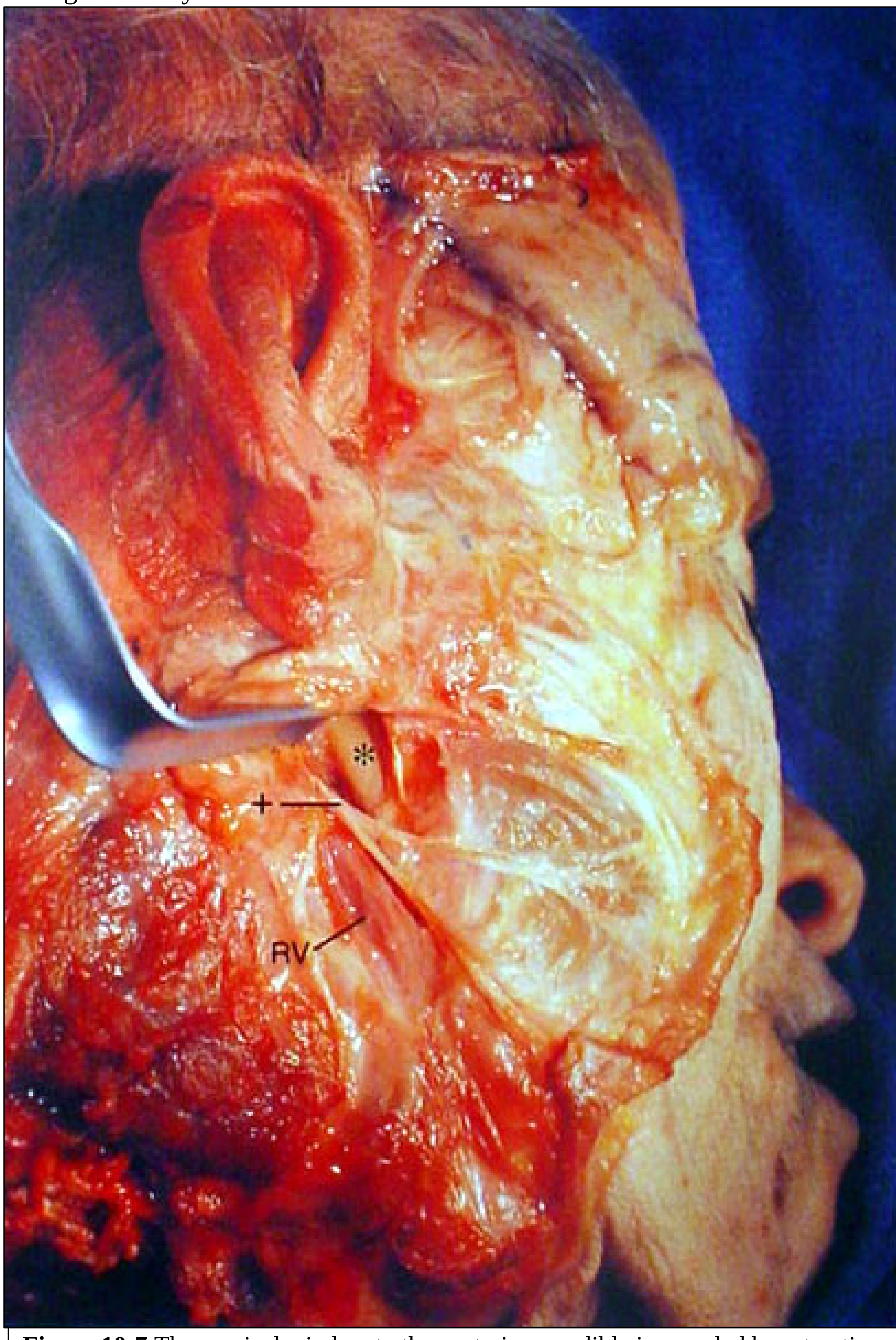

Figure 10-7 The surgical window to the posterior mandible is revealed by retraction of tissues between inferior (*) and posterior divisions of VII. The retractor is on the neck of the condyle (*). Note the path of the retromandibular vein (RV). The inferior division of VII can be retracted farther inferiorly to allow access to the gonial angle.

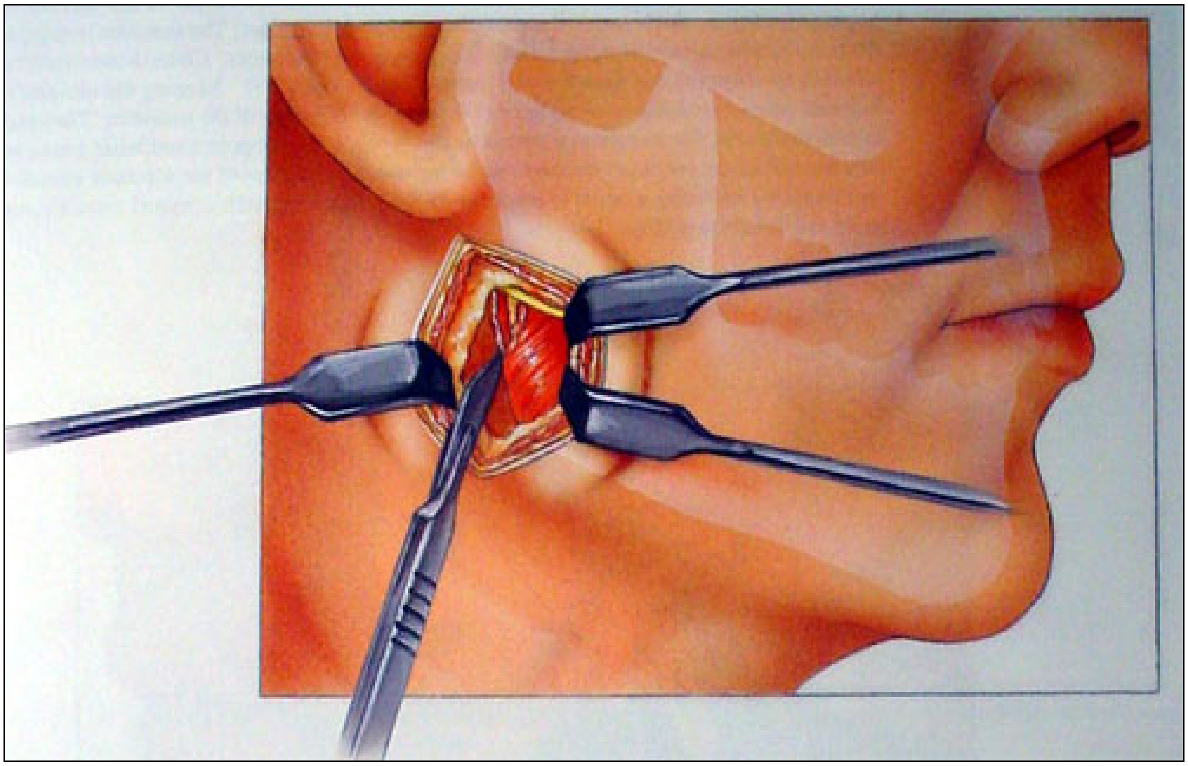

Figure 10-8 Incision through the pterygomasseteric sling along the posterior border of the mandible. The inferior division of VII is being retracted superiorly.

The sharp end of a periosteal elevator is draw along the length of the incision to begin stripping the tissues from the posterior border of the ramus. The masseter is stripped from the lateral surface of the mandible using periosteal elevators. Clean dissection is facilitated by stripping the muscle from top to bottom (Fig 10-9). Keeping the elevator in intimate contact with the bone reduces shredding and bleeding of the masseter. The entire lateral surface of the mandibular ramus to the level of the temporomandibular joint capsule as well as the coronoid process can be exposed. Retraction of the masseter muscle is facilitated by inserting a suitable retractor into the sigmoid notch (channel retractor, sigmoid notch retractor)(Figs. 10-10 to 10-12).

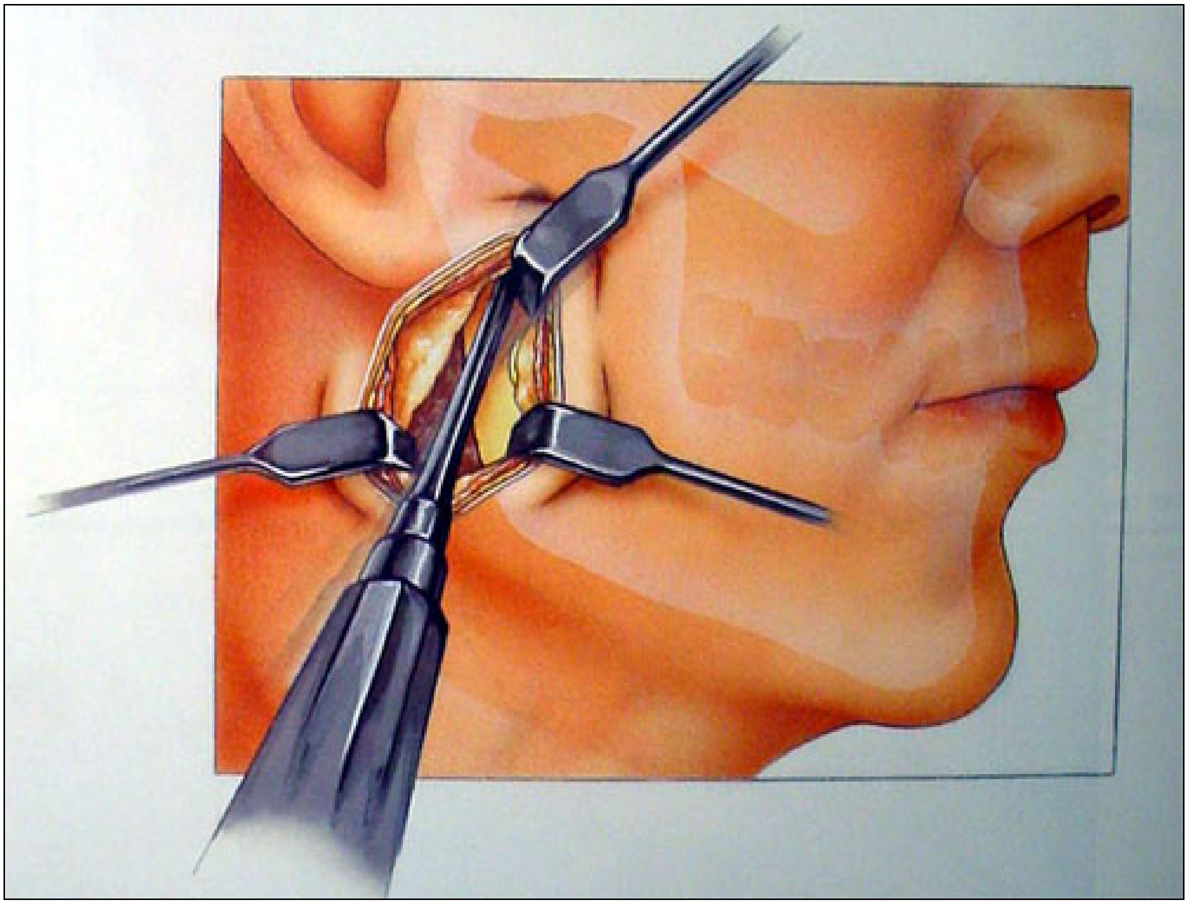

Figure 1 2 10-9 Subperiosteal dissection of the masseter muscle. The periosteal elevator is used to strip the muscle fibers from the top to the bottom of the ramus.

Figure 1 3 10-10 Sigmoid notch retractor. The curved flange at the end is inserted into the sigmoid notch, retracting the masseter muscle.

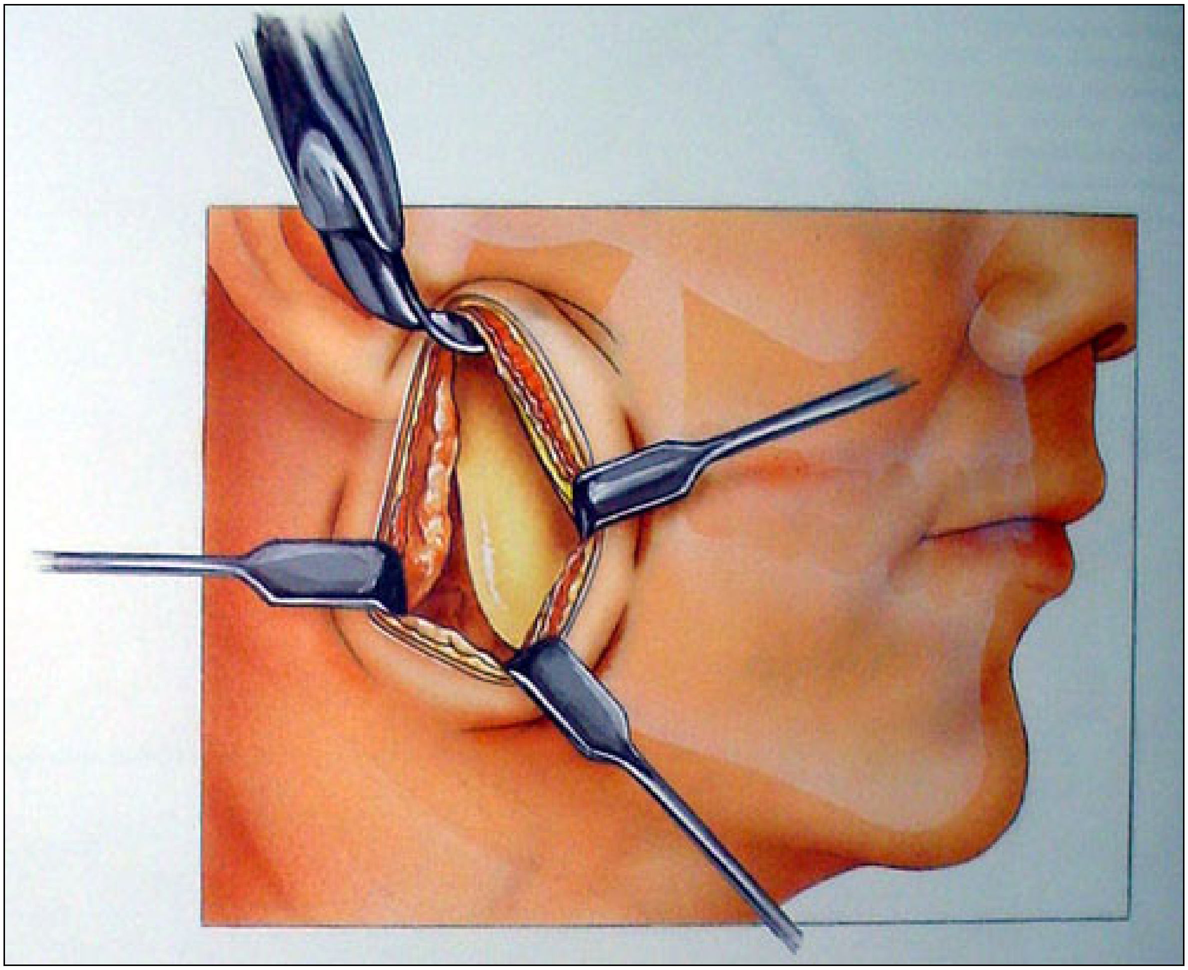

Figure 1 4 10-11 Exposure of the posterior ramus. The sigmoid notch retractor is placed into the sigmoid notch, elevating the masseter, parotid, and superficial tissues.

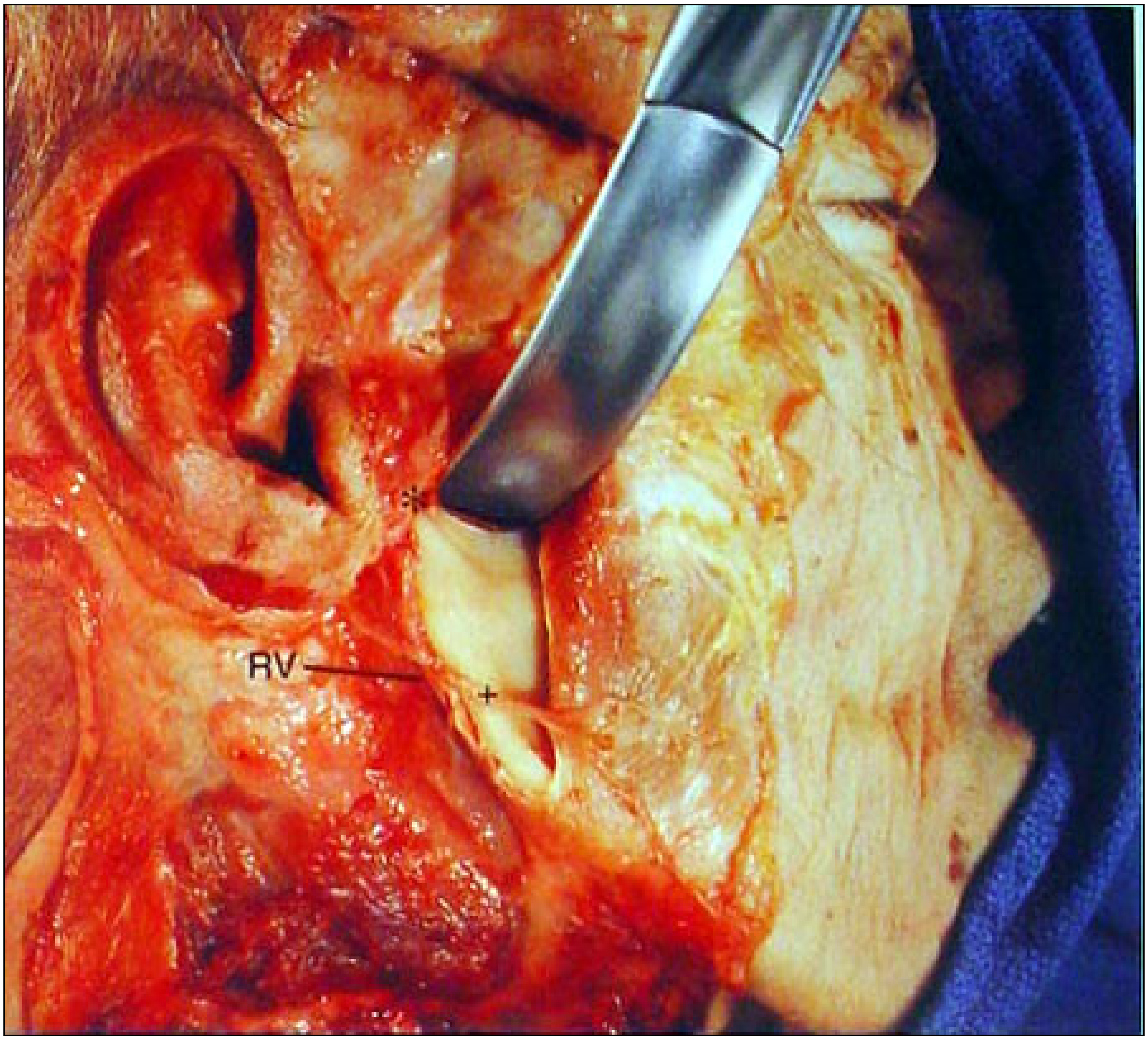

Figure 10-12 Anatomic dissection showing exposure of the posterior ramus with retraction of the superior division of VII by the channel retractor (*). + = marginal mandibular branch VII; RV = retromandibular vein

Step 6. Closure

The masseter and medial pterygoid muscles are sutures together with interrupt resorbable sutures. It may be difficult to pass the suture needle through the medial pterygoid muscle because it is very thin at the inferior and posterior borders of the mandible. To facilitate closure, the edge of the medial pterygoid muscle can be stripped for easier needle passage.

Closure of the parotid capsule/SMAS and platysma layer is important to avoid salivary fistula. A running, slowly resorbing horizontal mattress suture is used to tightly close the parotid capsule, SMAS, and platysma muscle in one watertight layer. Placement of subcutaneous sutures is followed by skin closure.

ALTERNATIVE APPROACHES TO THE MANDIBULAR RAMUS

Added exposure of the mandibular ramus is frequently required. Combinations of approaches such as the preauricular and the retromandibular offer increased exposure for some procedures, such as those for temporomandibular ankylosis. If even greater exposure is required, one can connect these two approaches using a modified Blair incision (Fig. 10-13). This incision is used frequently for operations involving the parotid, but it can be useful for those involving the mandibular ramus.

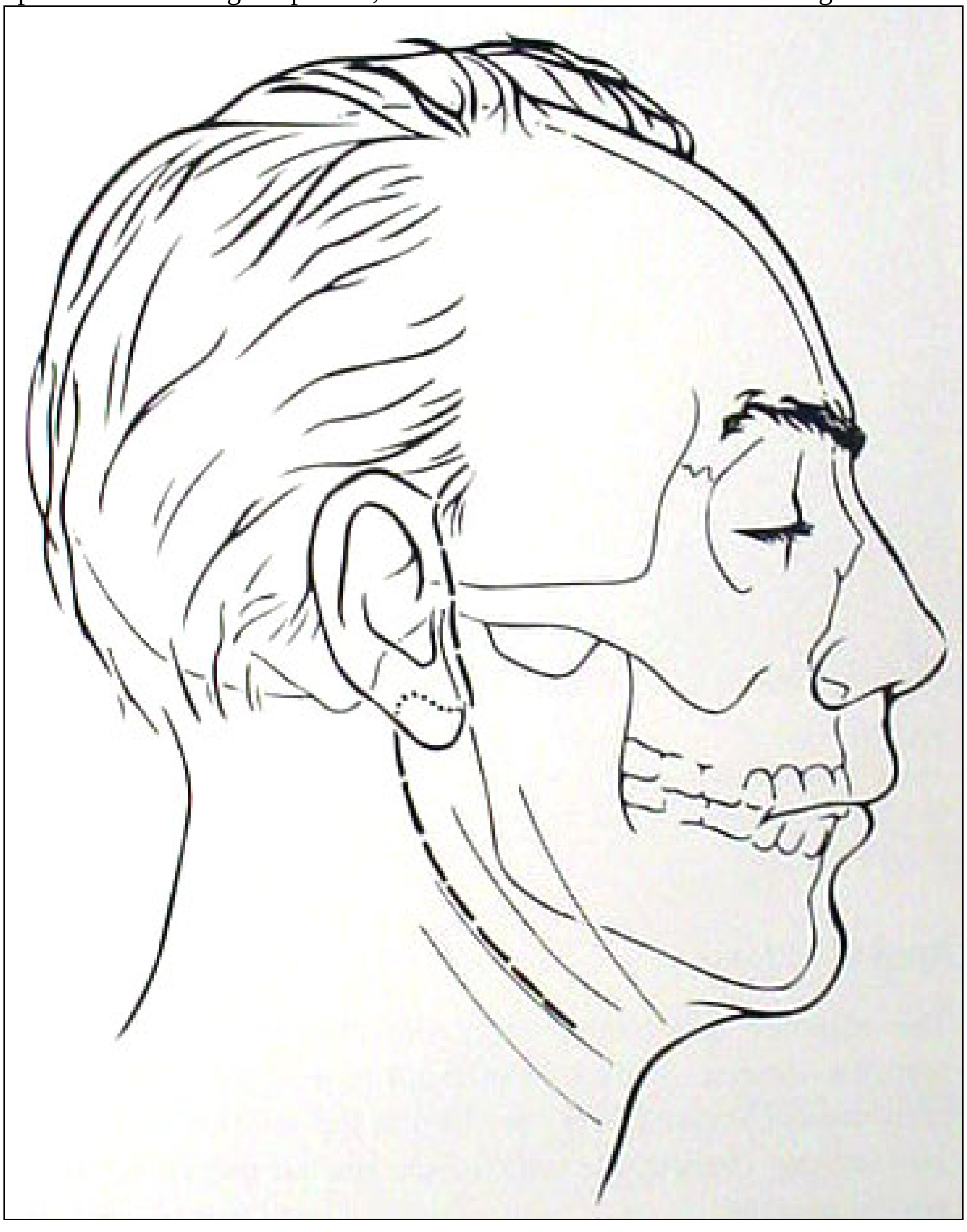

Figure 1 5 10-13 Modified Blair incision. The preauricular and retromandibular approaches are connected by an incision hidden in the lobular crease of the ear. The anteroposterior position of the retromandibular portion of the approach may be customized. In this illustration , the incision parallels the stenocleidomastiod muscle and is more posterior than the retromandibular approach described previously.

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11 Rhytidectomy Approach

The rhitidectomy or facelift approach to the mandibular ramus is a variant of the retromandibular approach. The only difference is that cutaneous incision is placed in a more hidden location, the same location as in facelift. The deeper dissection is the same as described for the retromandibular approach.

The main advantage of the rhytidectomy approach to the ramus is the les conspicuous facial scar. The disadvantage is the added time required for closure.

SURGICAL ANATOMY

Great Auricular Nerve

The only significant structure specific to this approach not mentioned for the retromandibular approach is the great auricular nerve. This sensory nerve begins deep in the neck as spinal roots C2 and C3, which fuse on the scalene muscle to form the great auricular nerve. As the nerve becomes more superficial, it emerges through the deep fascia of the neck at the middle of the posterior border of the sternocleidomastoid muscle. It crosses the sternocleidomastoid muscle at a 45^{o} angle toward the angle of the mandible, covered only by the superficial musculoaponeurotic layer (SMAS) and skin. The nerve lies behind the external jugular vein. The nerve then may split into two branches as it courses superiorly toward the lobe of the ear (Fig. 11-1). Some branches pass through the parotid gland and supply the skin of a part of the outer ear of a variably wide area in the region of the mandibular angle.

TECHNIQUE

Step 1. Preparation and Draping

Pertinent landmarks useful during dissection should be exposed throughout the surgical procedure. When the rhytidectomy approach to the mandible ramus/angle is used, the structures that should be visible in the field include the corner of the eye, the corner of the mouth, and the lower lip anteriorly; and the entire ear and descending hairline, as well as 2 to 3 cm of hair superior to the posterior hairline, posteriorly. The temporal area must also be completely exposed. Inferiorly, several centimeters of skin below the inferior border of the mandible are exposed to provide access for undermining the skin. Shaving the sideburns and temporal hair is unnecessary, except from a convenience standpoint.

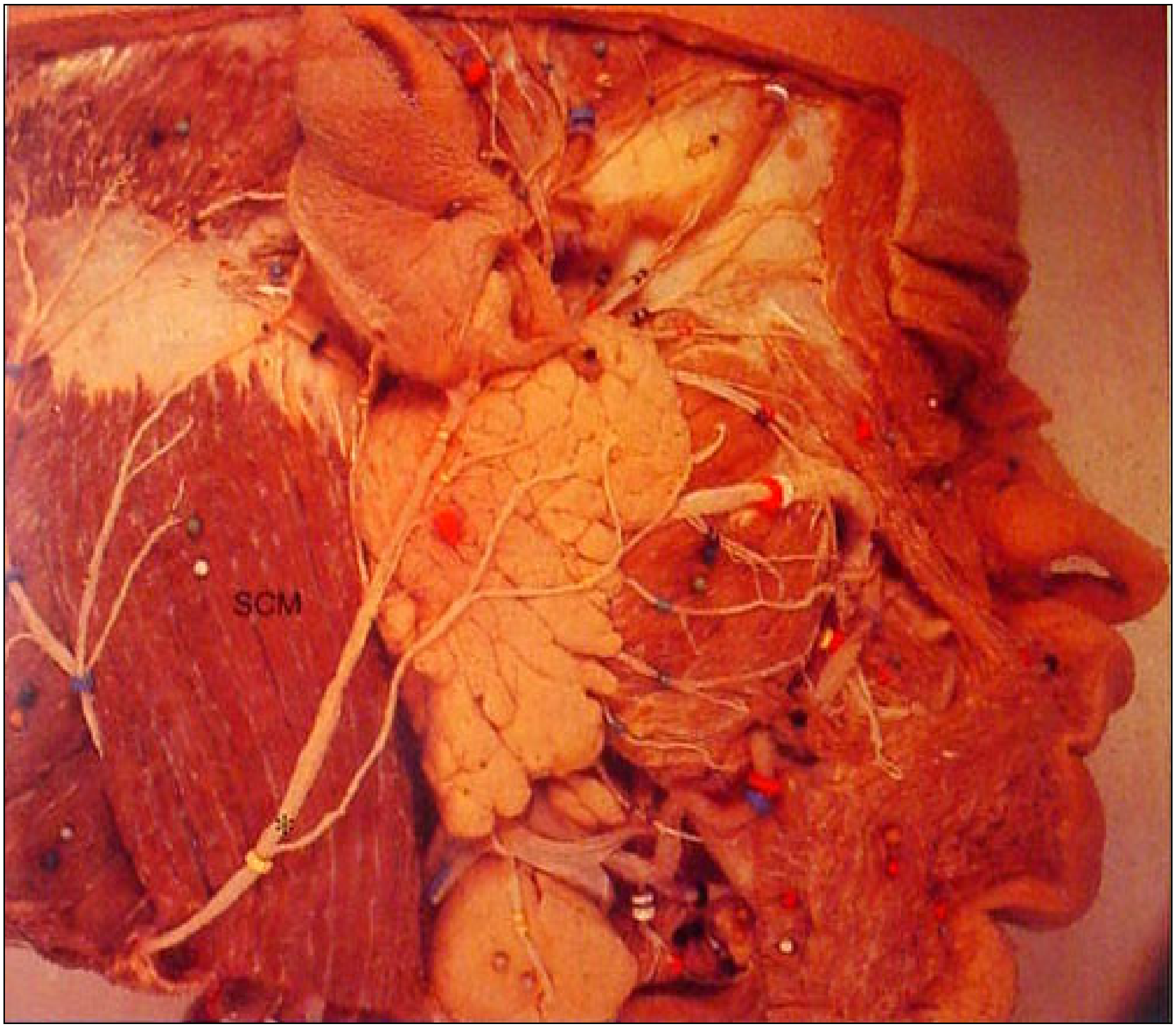


Figure 11- 1 Anatomic dissection showing the relationship of the great auricular nerve (*) to the sternocleidomastoid muscle (SCM) and ear.

Step 2. Marking the Incision and Vascoconstriction

The skin is marked before injection of a vasoconstrictor. The incision begins approximately 1,5 to 2 cm superior to the zygomatic arch just posterior to the anterior extent of the hairline (Fig. 11-2). The incision then curves posteriorly and inferiorly, blending into a preauricular incision in the natural crease anterior to the pinna (same position as in the preauricular approach to the temporomandibular joint, see Chap. 12). The incision continues under the lobe of the ear and approximately 3 mm onto the posterior surface of the auricle intead of in the mastoid-ear skin crease. This modification prevents a noticeable scar that occurs during contractive healing of the flap, pulling the scar into the neck. Instead, the incision is well hidden by the ear, it curves posteriorly toward the hairline and then runs along the hairline, or just inside it, for a few centimeters.

A vasoconstrictor is injected subcutaneously to aid hemostasis at the time of incision. One should not inject local anesthetics deep to the platysma muscle because of the risk of rendering the facial nerve branches nonconductive, making electrical testing impossible

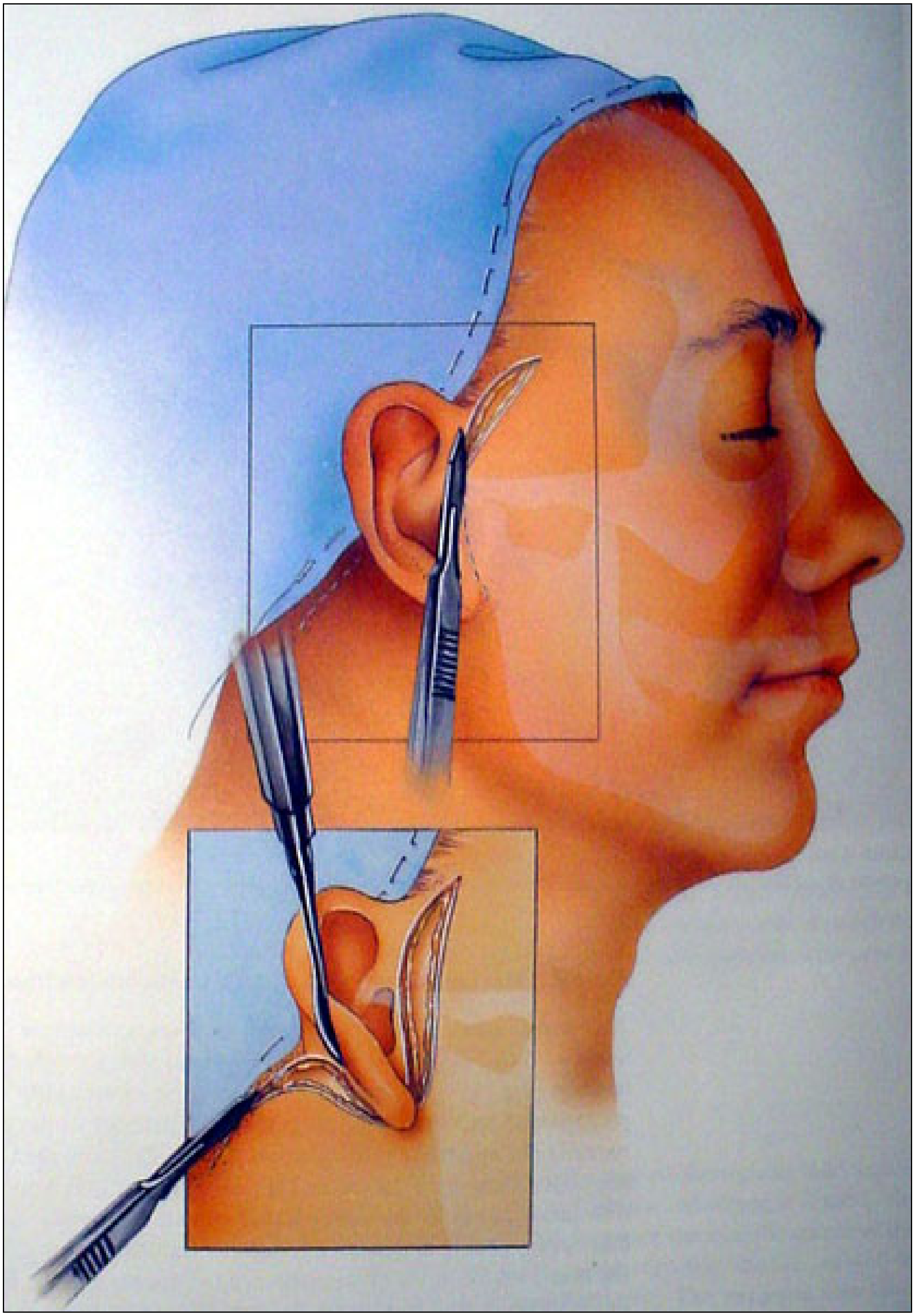


Figure 11- 2 Incision through skin and subcutaneous tissue.

Step 3. Skin Incision and Dissection

The initial incision is carried through skin and subcutaneous tissue only (Fig. 11-2). A skin flap is elevated through this incision using sharp and blunt dissection with Metzenbaum or rhitidectomy scissors (Fig. 11-3). The flap should be widely undermined to create a subcutaneous pocket that extends below the angle of the mandible and a few centimeters anterior to the posterior border of the mandible. No significant anatomic structures are in this plane except for the great auricular nerve, which should be deep to the subcutaneous dissection. Hemostasis is then achieved with electrocoagulation of bleeding subdermal vessels.

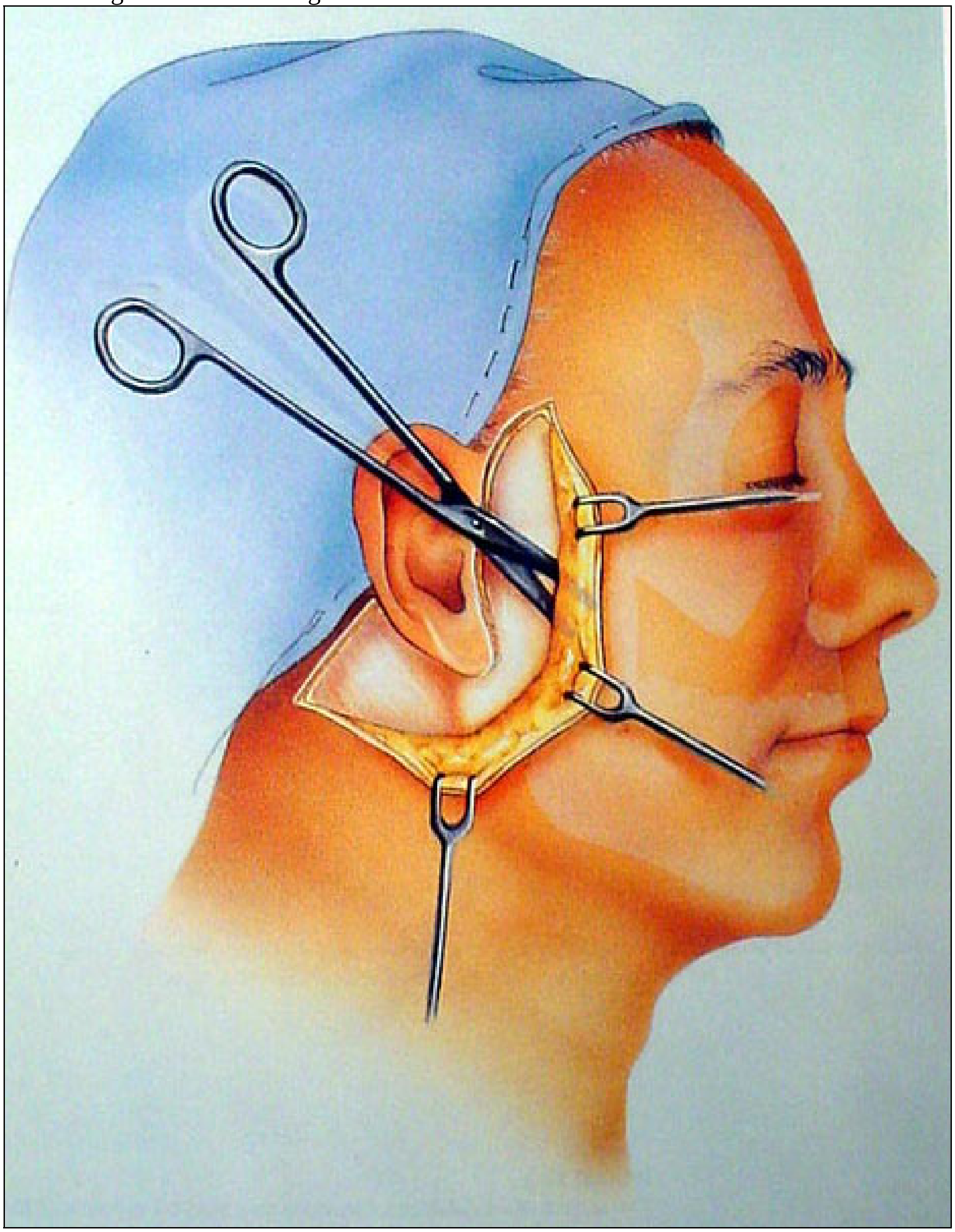


Figure 11- 3 Underminig of the skin with Metzenbaum of facelift scissors.

Step 4. Retromandibular Approach

Once the skin has been retracted anteriorly and inferiorly, the soft tissue overlying the posterior half of the mandibular ramus are visible (Fig. 11-4). From this point on, the dissection proceeds exactly as described for the retromandibular approach (see Chap. 10). The bony access is the same in both approaches (Fig. 11-5).

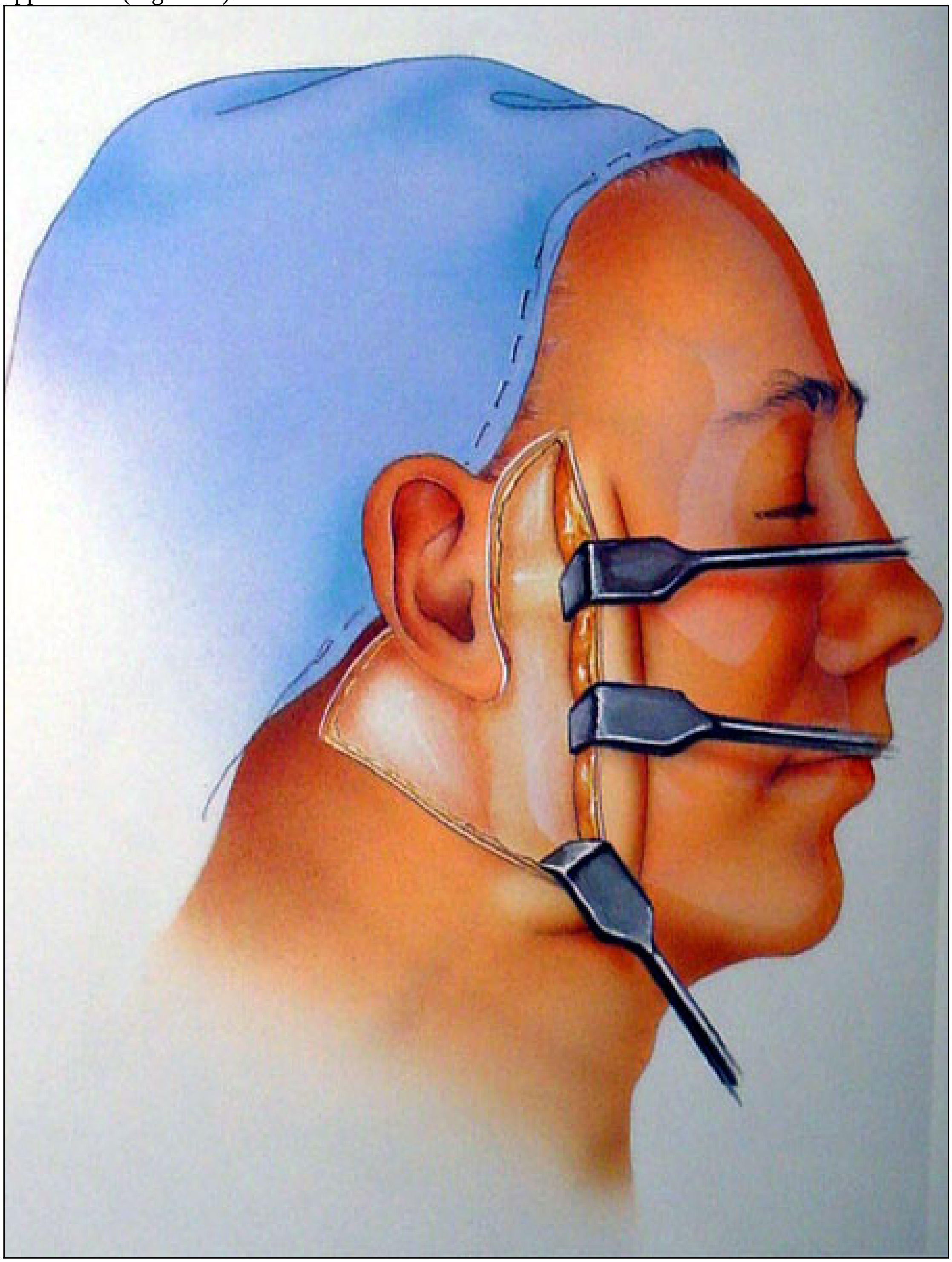


Figure 11- 4 The amount of subcutaneous dissection necessary for exposure of the posterior mandible.

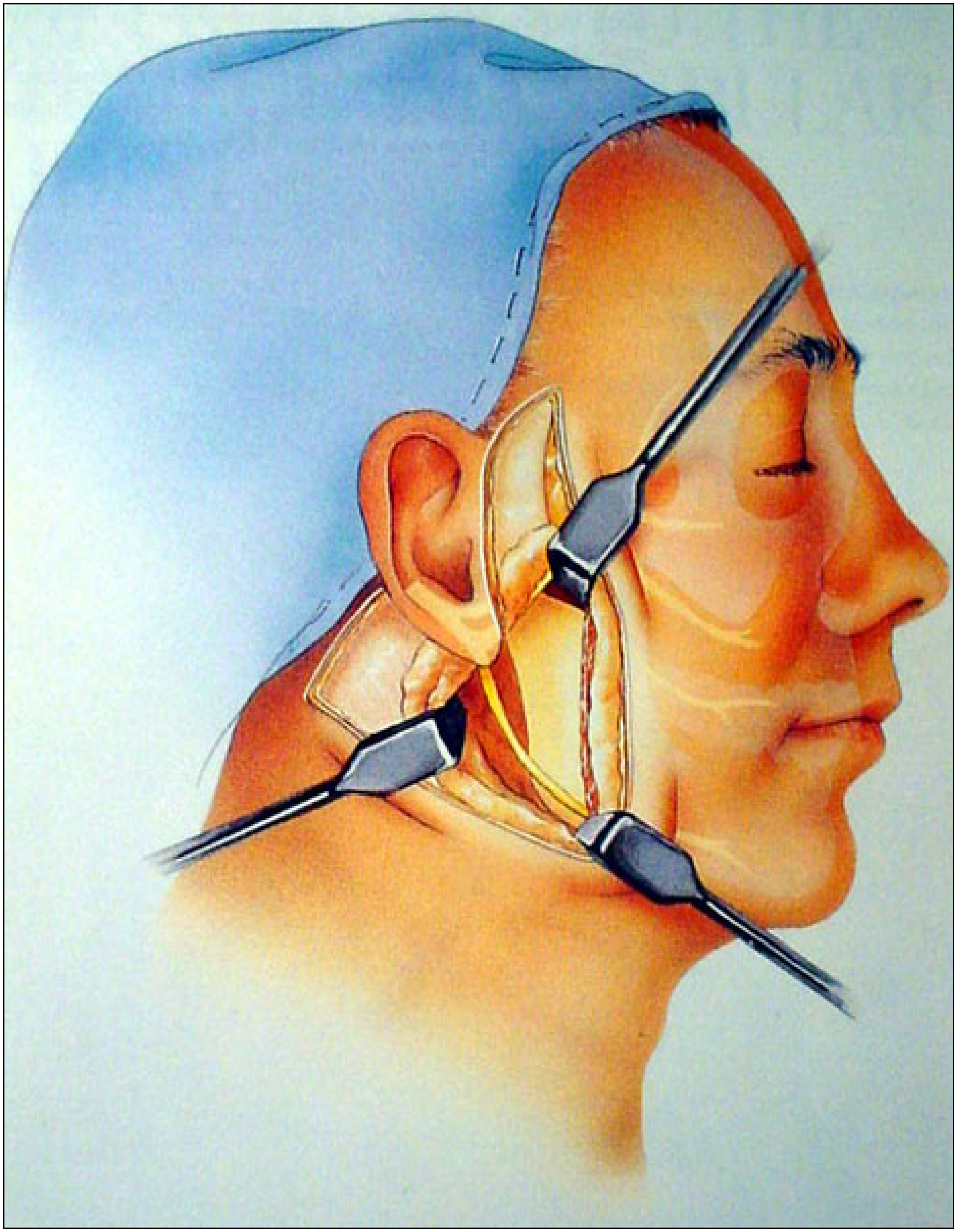


Figure 11- 5 The posterior mandible exposed through the rhytidectomy approach. The retractor is placed into the sigmoid notch, retracting the masseter, parotid, and superior branches of VII.

Step 5. Closure

Deep closure is performed as described for the retromandibular approach. After the parotid capsule/SMAS/platysma layer is closed, a 1/8- or 3/32-in. round vacuum drain is placed into the subcutaneous pocket to prevent hematoma formation. The drain can exit the posterior portion of the incision or a separate stab in the posterior part of the neck. A two-layer skin closure is performed (Fig. 11-6).

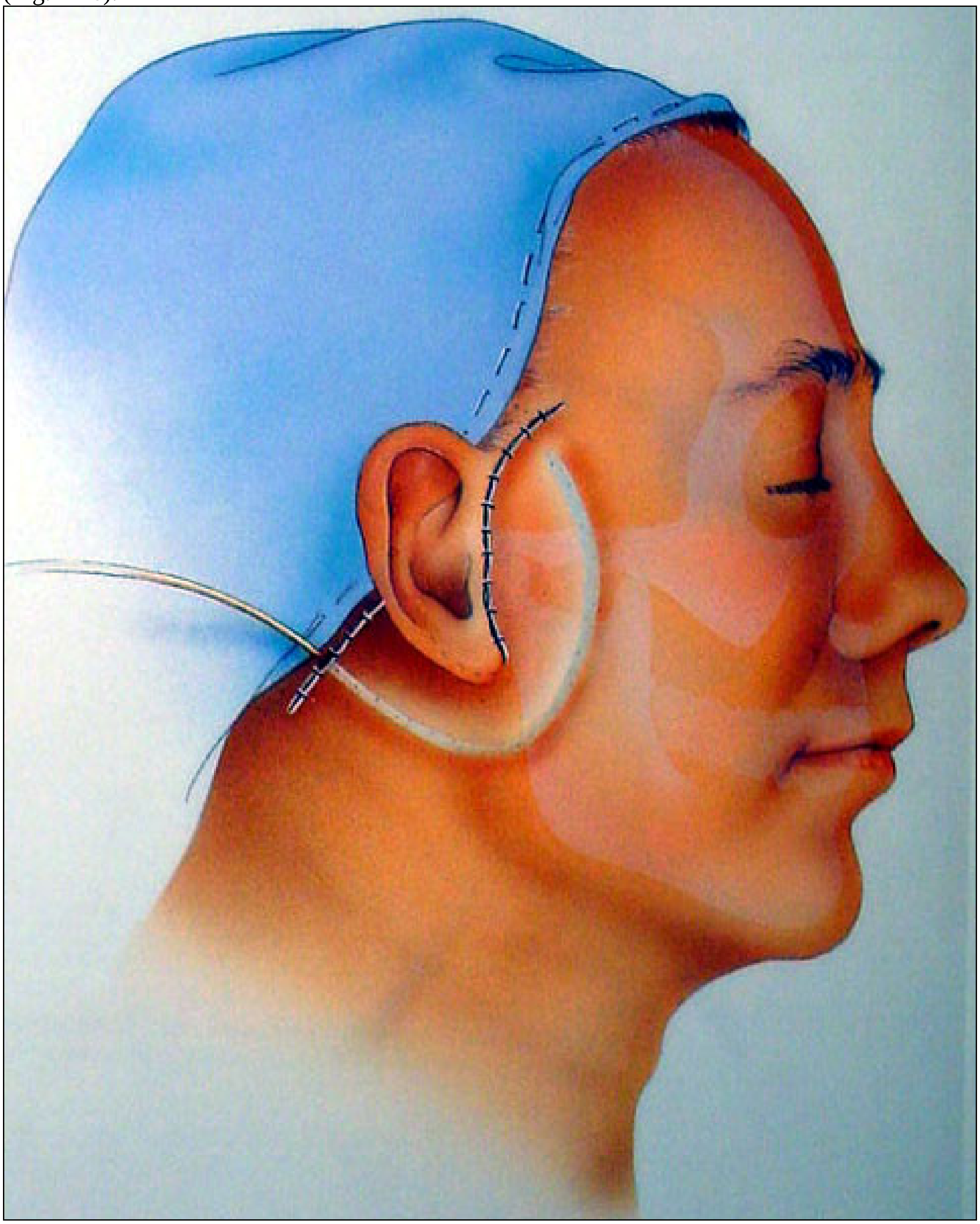
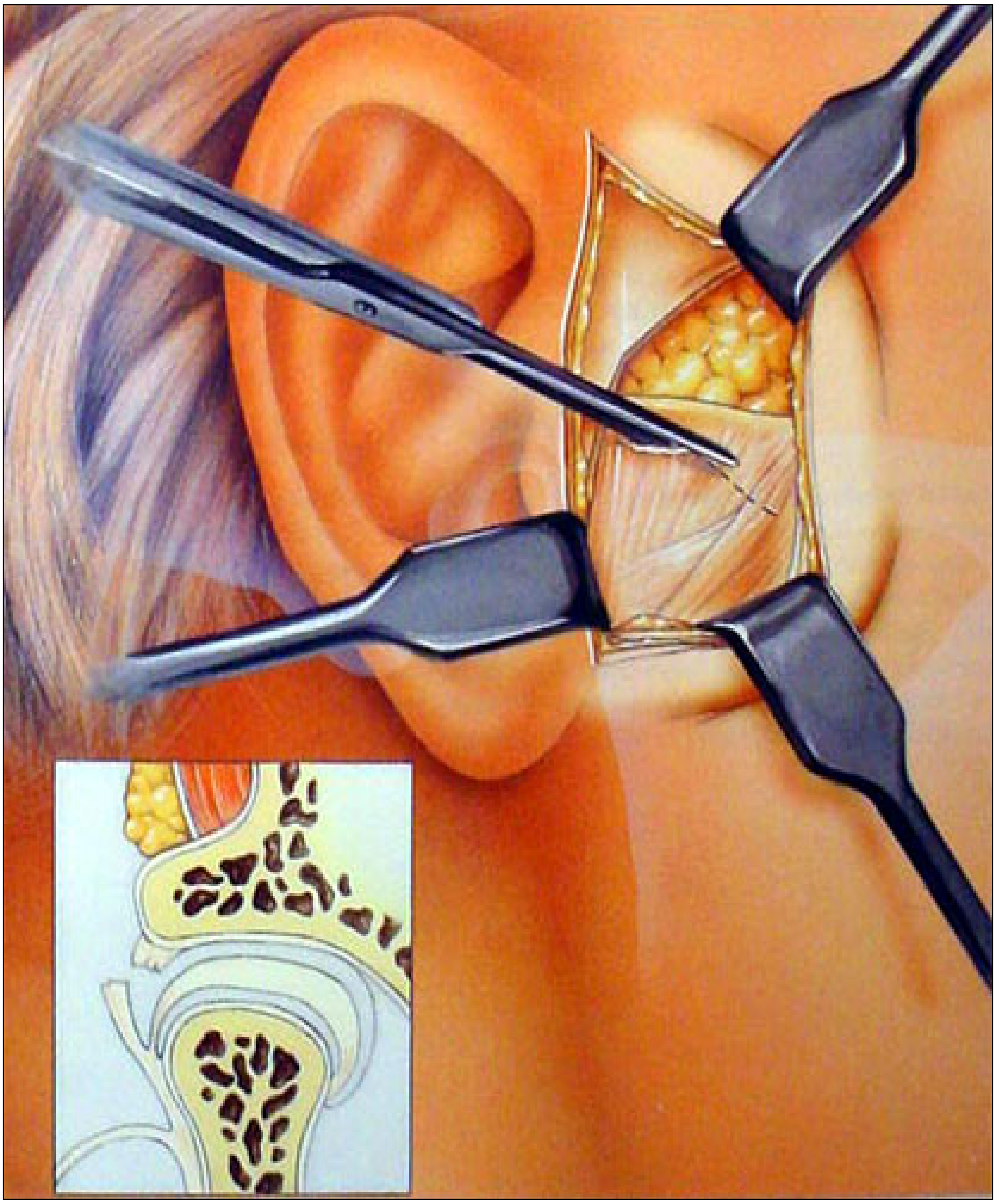


Figure 11- 6 Closure and subcutaneous drain placement.

SECTION

VI APPROACHES TO THE TEMPOROMANDIBULAR JOINT

The temporomandibular joint (TMJ) and its components frequently require exposure for a myriad of procedures. Internal derangements of the TMJ, arthritis, trauma, developmental disorders, and neoplasia may all affect the TMJ and/or the skeletal and soft tissue components. Several approaches to the TMJ have been proposed and used clinically. The standard and most basic, however, is the preauricular approach, which is described in detail in this section. Variation are briefly mentioned.



12 Preauricular Approach

Although the TMJ itself is relatively small, many important anatomic structures are nearby. This region contains the parotid gland, superficial temporal vessels, and facial and auriculotemporal nerves.

Parotid Gland

The parotid gland lies below the zygomatic arch, below and in front of the external acoustic meatus, on the masseter muscle, and behind the ramus of the mandible. The superficial pole of the parotid lies directly on the TMJ capsule. The parotid gland itself is enclosed within a capsule derived from the superficial layer of the deep cervical fascia, frequently called parotideomasseteric fascia.

Superficial Temporal Vessels

The superficial temporal vessels emerge from the superior aspect of the parotid gland and accompany the auriculotemporal nerve (Fig. 12-1). The superficial temporal artery arises in the parotid gland by bifurcation of the external carotid artery (the other terminal artery is the internal maxillary). As it crosses superficial to the zygomatic arch, a temporal branch is given off just over the arch. This vessel is a common source of bleeding. The superficial temporal artery divides into the frontal and parietal branches a few centimeters above the arch. The superficial temporal vein lies superficial and usually posterior to the artery. The auriculotemporal nerve accompanies, and is posterior to, the superficial temporal artery.

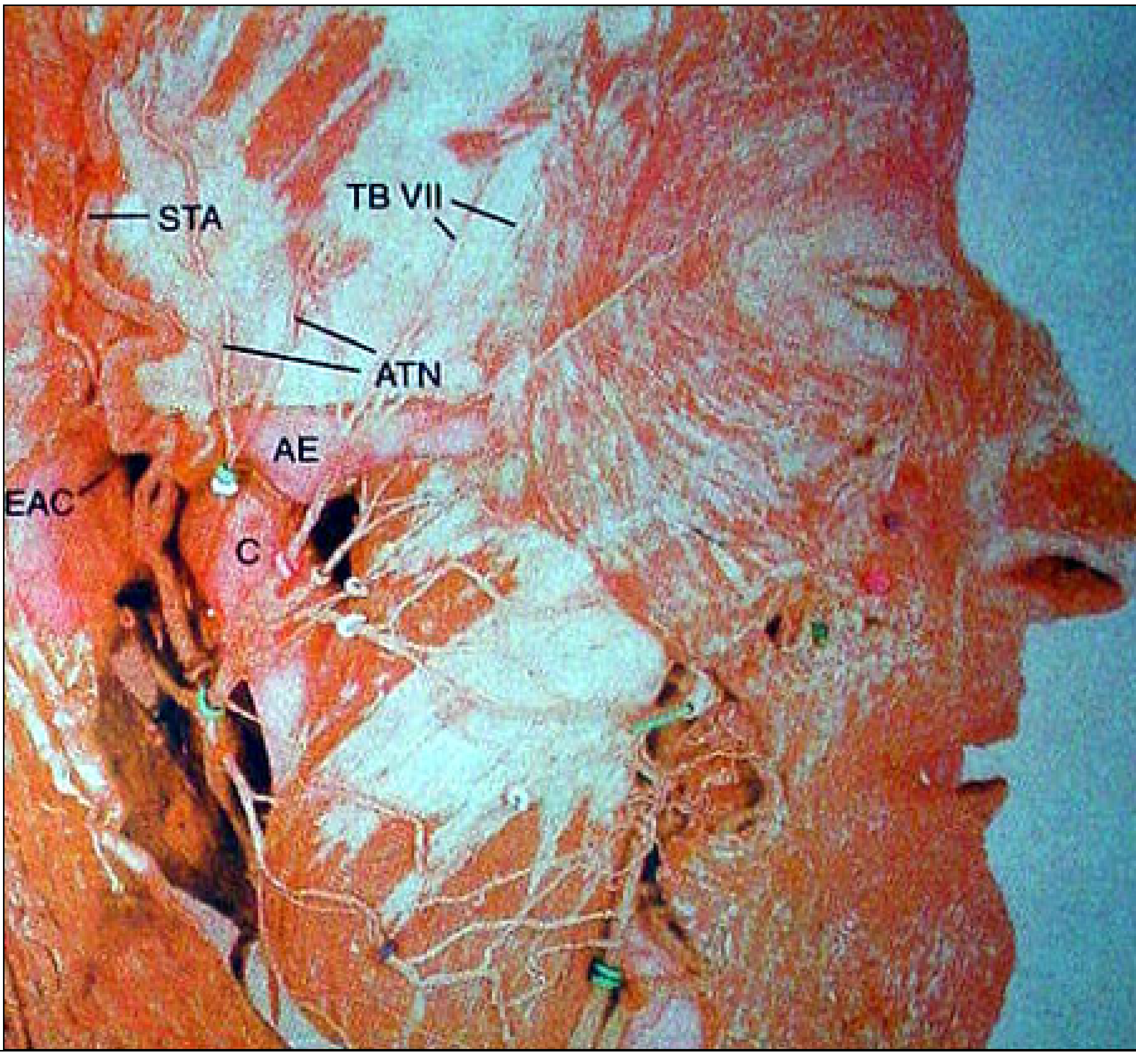


Figure 12 1 Anatomic dissection showing structures of importance : AE = articular eminence of the temporal bone; ATN = auriculotemporal nerves; C = condyle; EAC = external auditory canal (outer ear removed); STA = superficial temporal artery; TB VII = temporal branches of the facial nerve

Auriculotemporal Nerve

The auriculotemporal nerve supplies sensation to parts of the auricle, the external auditory meatus, the tympanic membrane, and the skin in the temporal area. It courses from the medial side of the posterior neck of the condyle and turns superiorly, running over the zygomatic root of the temporal bone (see Fig. 12-1). Just anterior to the auricle, the nerve divides into its terminal branches in the skin of the temporal area. Preauricular exposure of the TMJ area almost invariably injures this nerve. Damage is minimized by incision and dissection in close apposition to the cartilaginous portion of the external auditory meatus, realizing that this structure runs somewhat anteriorly as it courses from lateral to medial. Temporal extension of the skin incision should be located posteriorly so that the main distribution of the nerve is dissected and retracted forward within the flap. Fortunately, patients rarely complain about sensory disturbances that result from damage to this nerve.

Facial Nerve

Shortly after the facial nerve exits the skull through the stylomastoid foramen, it enters the parotid gland. At this point, the nerve usually divides into two main trunks (temporofacial and cervicofacial), the branches of which variably anastomose to form a parotid plexus. The division of the facial nerve is located between 1.5 and 2,8 cm below the lowest concavity of the bony external auditory canal.

Terminal branches of the facial nerve emerge from the parotid gland and radiate anteriorly (see Fig. 12-1). The terminal branches are commonly classified as temporal, zygomatic, buccal, marginal mandibular, and cervical. The location of the temporal branches is of particular concern during TMJ surgery, as these are the branches most likely to be damaged. As the temporal nerve branches (frequently two) cross the lateral surface of the zygomatic arch, they course along the undersurface of the temporoparietal fascia (see Fig. 6-5). The temporal branch crosses the zygomatic arch at varying locations from one individual to the next, and range anywhere from 8 to 35 mm (20 mm average) anterior to the external auditory canal (Fig. 12-2) (1). Therefore, protection of the temporal branches of the facial nerve can be achieved by routinely incising through the superficial layer of temporalis fascia and periosteum of the zygomatic arch not more than 0,8 cm in front of the anterior border of the external auditory canal.

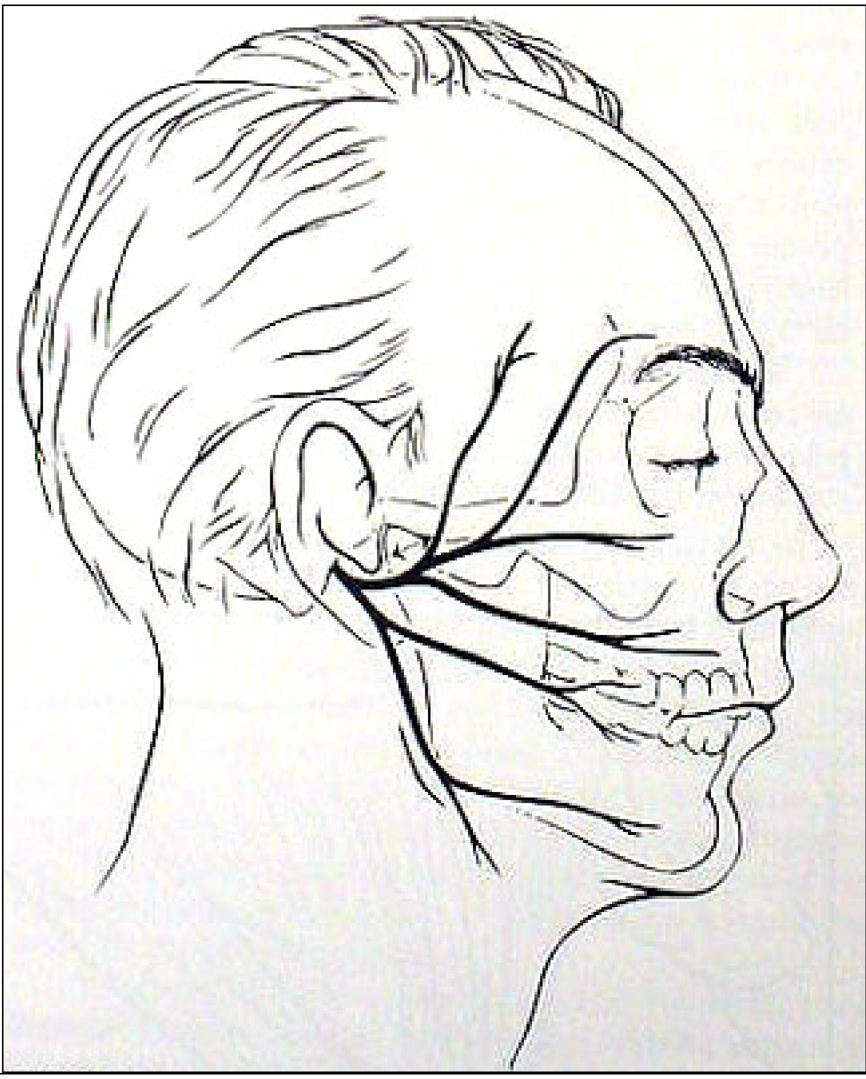


Figure 12 2 Major branches of the facial nerve. The distance from the anterior concavity of the external auditory canal to the crossing of the zygomatic arch by the temporal branch varies from 8 to 35 mm.

Temporomandibular Joint

The TMJ capsule defines the anatomic and functional boundaries of the TMJ. The thin, loose fibrous capsule surrounds the articular surface of the condyle and blends with the periosteum of the mandibular neck. On the temporal bone, the articular capsule completely surrounds the articular surfaces of the eminence and fossa (Fig. 12-3). Attachments of the capsule adhere firmly to bone. Anteriorly, the capsule is attached in front of the crest of the articular eminence; laterally, it adheres to the edge of the eminence and fossa; and posteriorly, it extends medially along the anterior lip of the squamotympanic and petrotympanic fissure. The medial attachment runs along the sphenosquamosal suture. The articular capsule is strongly reinforced laterally by the temporomandibular (lateral) ligament, composed of a superficial fan-shaped layer of obliquely oriented connective tissue fibers and a deeper, narrow band of fibers that run more horizontally (Fig. 12-3). The ligament attaches broadly to the outer surface of the root of the zygomatic arch and converges downward and backward to attach to the back of the condyle below and behind its lateral pole.

The articular disk is a firm but flexible structure with a biconcave shape (Fig. 12-4). The disk is usually divided into three regions: posterior band, intermediate zone, and anterior band. The central intermediate zone is considerably thinner (1 mm) than the posterior (3 mm) and anterior (2 mm) bands. The upper surface of the disk adapts to the contours of the fossa and eminence of the temporal bone, and the lower surface of the disk adapts to the contour of the mandibular condyle.

Posteriorly, the disk and the loosely organized posterior attachment tissues (bilaminar zone, retrodiscal pad) are contiguous. The retrodiscal tissues are attached to the tympanic plate of the temporal bone posterosuperiorly and to the neck of the condyle posteroinferiorly. Anteriorly, the disk and the capsule and fascia of the superior head of the lateral pterygoid muscle are contiguous. The superior head of the lateral pterygoid muscle may have some fibers inserting directly into the disk anteromedially.

The articular disk of the TMJ is a hypovascular intra-articular structure that separates the condylar head from the glenoid fossa. It is firmly attached to the condyle at its lateral pole; it is not directly attached to the temporal bone. The articular disk and its posterior attachment tissues merge with the capsule around their periphery. The disk and its attachment divide the

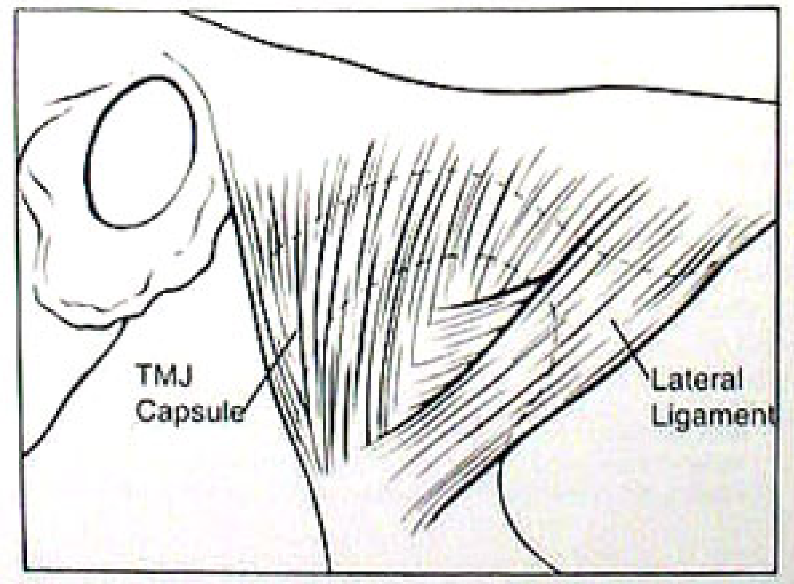


Figure 12 3 The temporomandibular joint (TMJ) capsule and lateral ligament. The lateral ligament has both oblique and horizontal components.

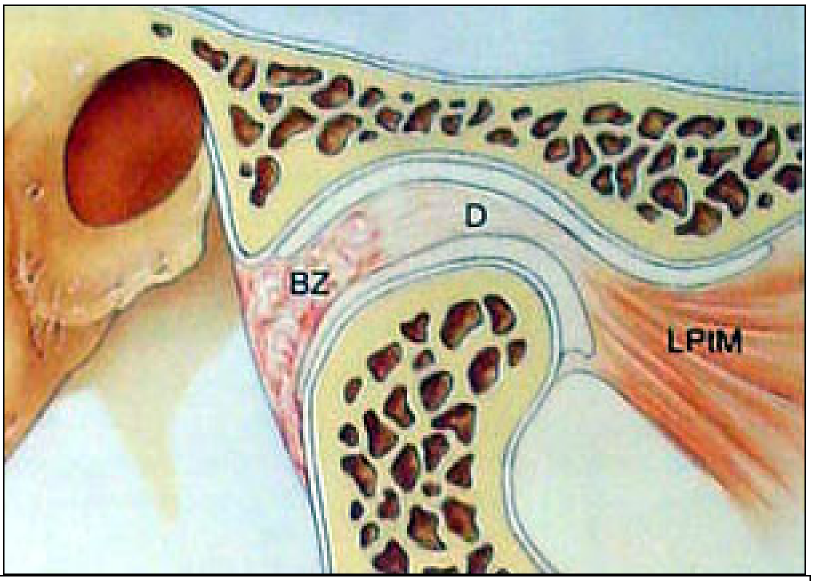


Figure 12 4 Sagital section through the temporomandibular joint (TMJ). The articular disk (D) is white because of its avascularity. The bilaminar zone (BZ) is red as a result of its lush blood supply . The lateral pterygoid muscle (LPtM) may have some fibers that attach to the anterior portion of the disk

joint space into separate superior and inferior spaces. In the sagital plane, the upper joint space is contiguous with the glenoid fossa and the articular eminence. The upper joint space always extends farther anteriorly than the lower joint space. The lower joint space is contiguous with the condyle and extends only slightly anterior to the condyle along the superior aspect of the superior head of the lateral pterygoid muscle. In the frontal plane, the upper joint space overlaps the lower joint space. Therefore, entrance through the lateral capsule starts in the superior compartment.

Layers of the Temporomandibular Region

The *temporoparietal fascia* is the most superficial fascia layer beneath the subcutaneous fat (Fig. 12-5). This fascia is the lateral extension of the galea and is continuous with the superficial musculoaponeurotic layer (SMAS). It is frequently called the superficial temporal fascia or the suprazygomatic SMAS. It is easy to miss this layer completely when incising the skin, because it is just beneath the surface. The blood vessels of the scalp, such as the superficial temporal vessels, run along its superficial aspect closely related to the subcutaneous fat. On the other hand, the motor nerves, such as the temporal branch of the facial nerve, run on the deep surface of the temporoparietal fascia.

The *subgaleal fascia* in the temporoparietal region is well developed and can be dissected as a discrete fascial layer if desired, but it is usually used only as a cleavage plane in the standard Preauricular approach.

The *temporalis fascia* is the fascia of the temporalis muscle. This thick fascia arises from the superior temporal line and fuses with the pericranium. The temporalis muscle arises from the deep surface of the temporal fascia and the whole of the temporal fossa. Inferiorly, at the level of the superior orbital rim, the temporal fascia splints into medial border of the zygomatic arch. A small quantity of fat between the two layers is sometimes called the superficial temporal fat pad. A large vein frequently runs just deep to the superficial layer of temporalis fascia.

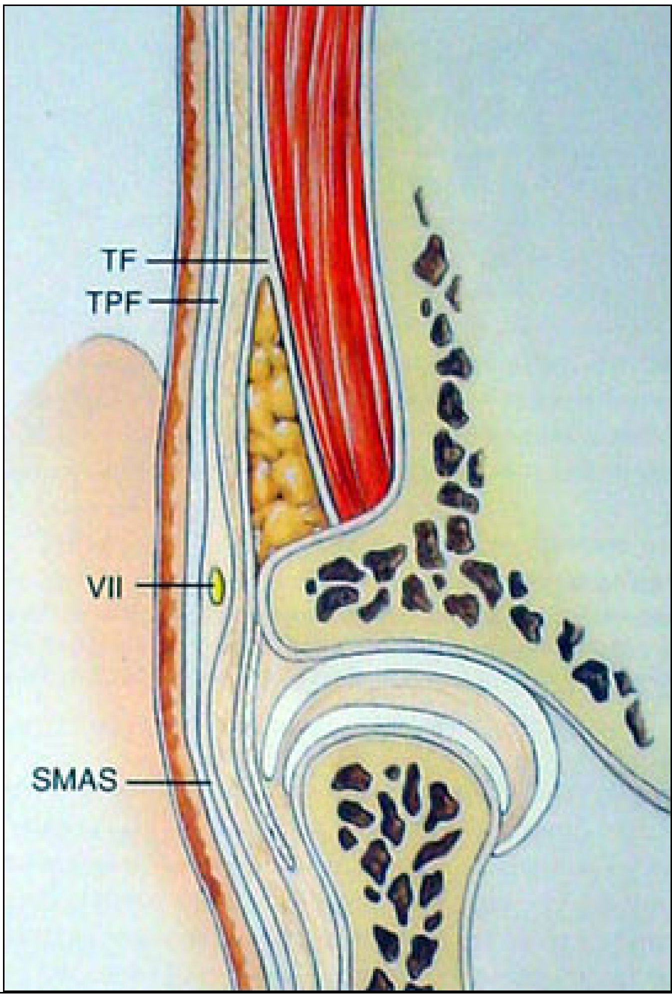


Figure 12 5 Coronal section of the temporomandibular joint (TMJ) region. SMAS = superficial musculoaponeurotic system; TF = temporalis fascia (note that it splits inferior to this point into superficial and deep layers); TPF = temporoparietal fascia; VII = temporal branch of the facial nerve.

TECHNIQUE

Several approaches to the TMJ have been proposed and are used clinically. The standard and most basic is the Preauricular approach. Other approaches differ in term of placement of the skin incision as well as access to the joint. The dissection down to the TMJ, however, is similar in all approaches. In this discussion, the standard Preauricular approach is described first. Later, variants are briefly presented.

Step 1. Preparation of the Surgical Site

Preparation and draping should expose the entire ear and lateral canthus of the eye. Shaving the Preauricular hair is optional. A sterile plastic drape can be used to keep the hair out of the surgical field. Cotton soaked in mineral oil or antibiotic ointment may be placed into the external auditory canal.

Step 2. Marking the Incision

The incision is outlined at the junction of the facial skin with helix of the ear. A natural skin fold along the entire length of the junction of the incision can be used. If none is present, posterior digital pressure on the Preauricular skin usually creates a skin fold that can be marked. The incision extends superiorly to the top of the helix, and may include an anterior (hockey-stick) extension.

Step 3. Infiltration of Vasoconstrictor

The Preauricular area is quite vascular. A vasoconstrictor can be injected subcutaneously in the area of the incision to decrease incisional bleeding. If a local anesthetic is also being injected, however, it should not be injected deeply because it may be necessary to use a nerve stimulator on exposed facial nerve branches.

Step 4. Skin Incision

The incision is made through skin and subcutaneous connective tissues (including temporoparietal fascia) to the depth of the temporalis fascia (superficial layer) (Fig. 12-6). Any bleeding skin vessels are cauterized before deeper dissection proceeds.

Step 5. Dissection to the TMJ Capsule

Blunt dissection with periosteal elevators undermines the *superior portion* of the incision (that above the zygomatic arch) so that a flap can be retracted anteriorly for approximately 1 to 1,5 cm (Fig. 12-7). This flap is dissected anteriorly at the level of the superficial (outer) layer of temporalis fascia. This layer is usually hypovascular. The superficial temporal vessels and auriculotemporal nerve may be retracted anteriorly in the flap. Failure to develop the flap close to the cartilaginous external auditory canal increases the risk of damage to these structures.

Below the zygomatic arch, dissection proceeds bluntly adjacent to the external auditory cartilage. Scissor dissection proceeds along the external auditory cartilage in an avascular plane between it and the glenoid lobe of the parotid gland (see Fig. 12-7). The external auditory cartilage runs anteromedially and the dissection is parallel to the cartilage. The depth of the dissection at this point should be similar to that above the zygomatic arch.

Figure 12 6 Initial incision made in the preauricular skin fold.

Figure 12 7 Dissection above the zygomatic arch to the level of the superficial layer of the temporalis fascia. Dissection below the zygomatic arch along the external auditory meatus to the same depth.

Attention again turns to the portion of the incision above the zygomatic arch. With the flap retracted anteriorly, an incision is made through the superficial (outer) layer of temporalis fascia beginning from the root of the zygomatic arch just in front of the tragus anteroposteriorly toward the upper corner of the retracted flap (Fig. 12-8). The fat globules contained between the superficial and deep layers of temporalis fascia are then exposed. At the root of the zygoma, the

Figure 12 8 Oblique incision through the superficial layer of the temporalis fascia. Fat is visible deep to the fascia.

incision can be through both the superficial layer of temporalis fascia and periosteum of the zygomatic arch. The sharp end of a periosteal elevator is inserted in the fascial incision, deep to the superficial layer of temporalis fascia, and swept back and forth to dissect this tissue from the underlying areolar and adipose tissues (Fig. 12-9). The undermining proceeds inferiorly toward

Figure 12 9 A periosteal elevator inserted beneath the superficial layer of the temporalis muscle is used to strip periosteum off the lateral portion of the zygomatic arch, and continues the dissection below the arch just superficial to the capsule of the temporomandibular joint the zygomatic arch, where the sharp end of the periosteal elevator cleaves the attachment of the periosteum at the junction of the lateral and superior surfaces of the zygomatic arch, freeing the periosteum from its lateral surface. The periosteal elevator can then be used to continue bluntly dissecting inferiorly with the black-and-forth motion, taking care not to dissect medially into the TMJ capsule (Fig. 12-10). Blunt dissection with scissors can also be used to dissect inferiorly to the zygomatic arch. Once the dissection is approximately 1 cm below the arch, the intervening tissue is sharply released posteriorly along the plane of the initial incision (Fig. 12-11).

The entire flap is then retracted anteriorly, and blunt dissection at this depth proceeds anteriorly until the articular eminence is exposed. The entire TMJ capsule should then be revealed. Because of subperiosteal dissection along the lateral surface of the zygomatic arch, the temporal branches of the facial nerve are located within the substance of the retracted flap (see Fig. 12-10). To help determine the location of the articular space, the mandible can be manipulated open and closed.

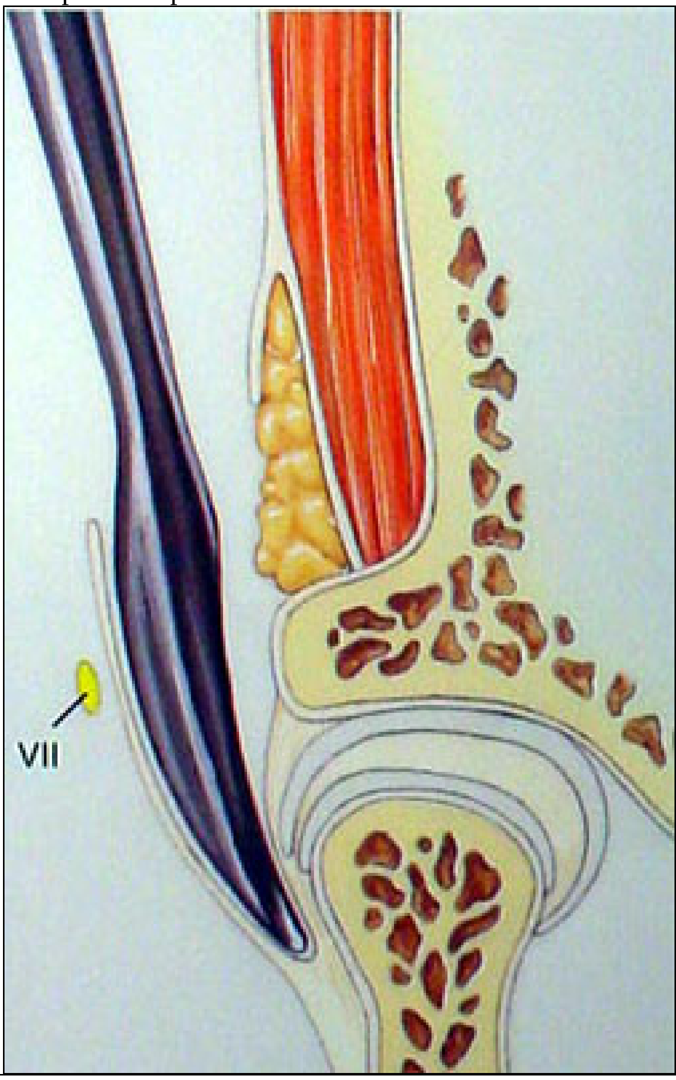


Figure 12 10 Coronal section showing the layer of dissection. VII = relative position at temporal branch during dissection.

Figure 12 11 Vertical incision made through intervening tissues just in front of the external auditory meatus to the depth of the periosteal elevator.

Figure 12 12 After retraction of tissues superficial to the temporomandibular joint (TMJ) capsule, scissors are used to enter the capsule. Initial point of entry is just below the zygomatic arch, continuing parallel to the contour of the TMJ fossa.

Step 6. Exposing the Interarticular Spaces

With retraction of the developed flap, the joint spaces can be entered. With the condyle distracted inferiorly, pointed scissors enter the upper joint space anteriorly along the posterior slope of the eminence (Fig. 12-12). The opening is extended anteroposteriorly by cutting along the lateral aspect of the eminence and fossa. The incision is continued inferiorly along the posterior portion of the capsule until the capsule blends with the posterior attachment of the disk. Lateral retraction of the capsule allows entrance into the superior joint space.

The inferior joint space is opened by making an incision in the disk along its lateral attachment to the condyle within the lateral recess of the upper joint space (Fig. 12-13). The incision may be extended posteriorly into the attachment tissues. The inferior joint space is then entered.

Step 7. Closure

The joint spaces are irrigated thoroughly and any hemorrhage is controlled before closure. The inferior joint space is closed with permanent or slowly resorbing suture by suturing the disk back to its lateral condylar attachment (Fig. 12-14). The superior joint space is closed by suturing the incised edge with the remaining capsular attachments on the temporal component of the TMJ (Fig. 12-15). If no such attachments were left attached to bone, the capsule can be resuspended over the zygomatic arch to the temporalis fascia.

Figure 12 13 Incision through the lateral attachment of the temporomandibular joint disk, entering the inferior joint space.

Figure 12 14 Closure of the inferior joint space using running suture between lateral disk attachments and the joint capsule.

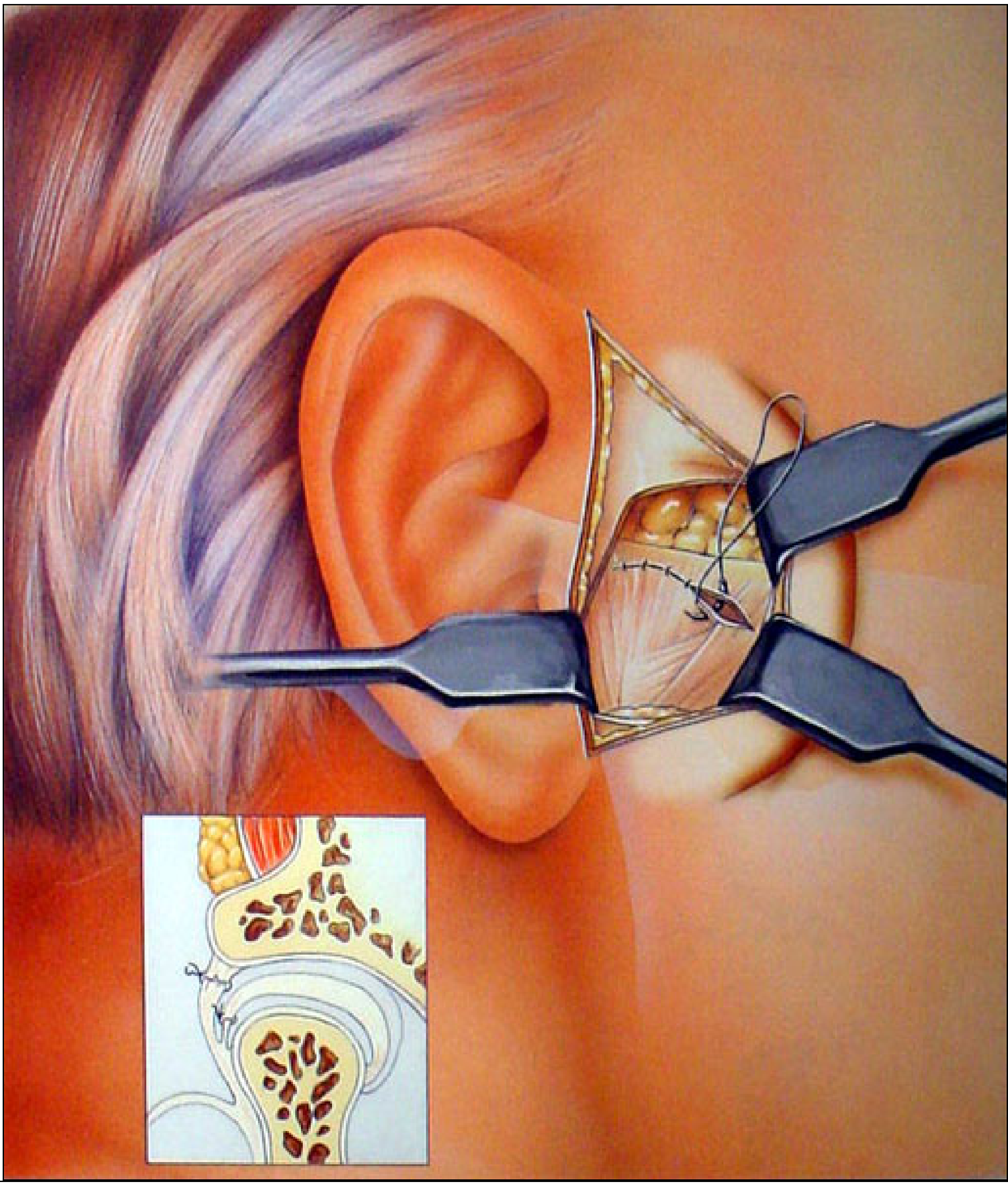


Figure 12 15 Closure of the superior joint space using running suture between remnants of the temporomandibular joint (TMJ) capsule on the zygomatic arch and the TMJ capsule below.

Subcutaneous tissues are closed with resorbable sutures. No sutures deeper than subcutaneous tissues are required. The skin is then closed. A running subcuticular suture makes removal simple and allows a delay in removal if necessary (Fig. 12-16). A pressure dressing is usually applied, taking care to bolster posterior to the ear.

Figure 12 16 Closure of the preauricular skin incision with running subcuticular suture.

ALTERNATE APPROACHES

Other approaches to the TMJ have been described and used clinically. The extended temporal and coronal incision can proceed inferiorly in the same fashion as for a Preauricular incision to expose the TMJ. The “extended” preauricular approach incision is similar to the preauricular approach, but an anterosuperior extension(hockey-stick) is made in the hair-bearing temporal skin (Fig. 12-17). Some surgeons choose to bring the preauricular incision behind the tragus (endaural incision) to hide a portion of it (Fig. 12-18). This choice may be especially useful in individuals, often young patients, who do not have a well-demarcated preauricular skin fold. A retroauricular skin incision further hides the incision and helps to protect the auriculotemporal nerve. This approach requires an arc-shaped incision behind the ear (Fig. 12-19). The external auditory canal must be transected at a wide portion to prevent stenosis, and the ear is reflected anteriorly to gain access to the joint. The same deeper dissection is effective for all of the approaches just described.

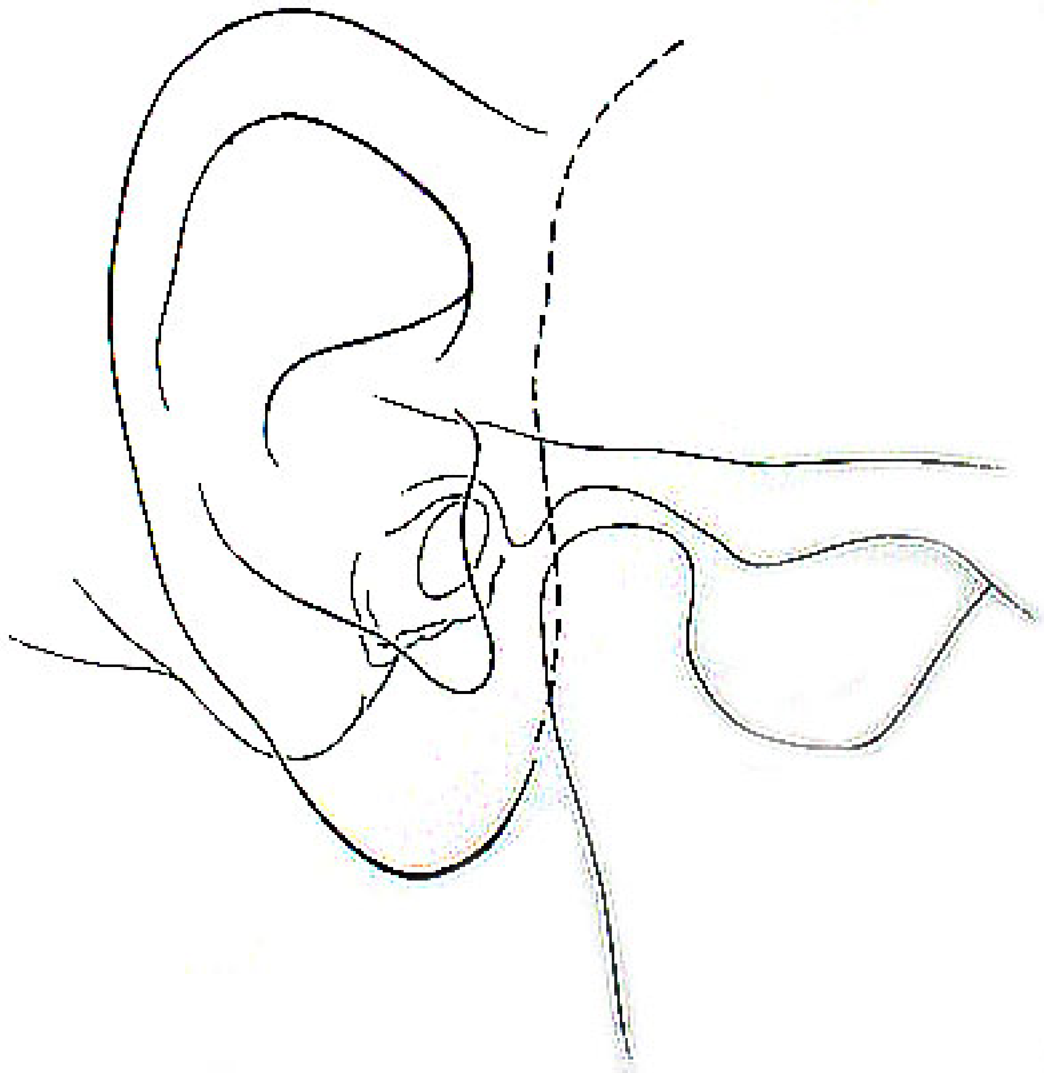


Figure 12 17. Preauricular incision with an oblique anterosuperior extension ("hockey stick").

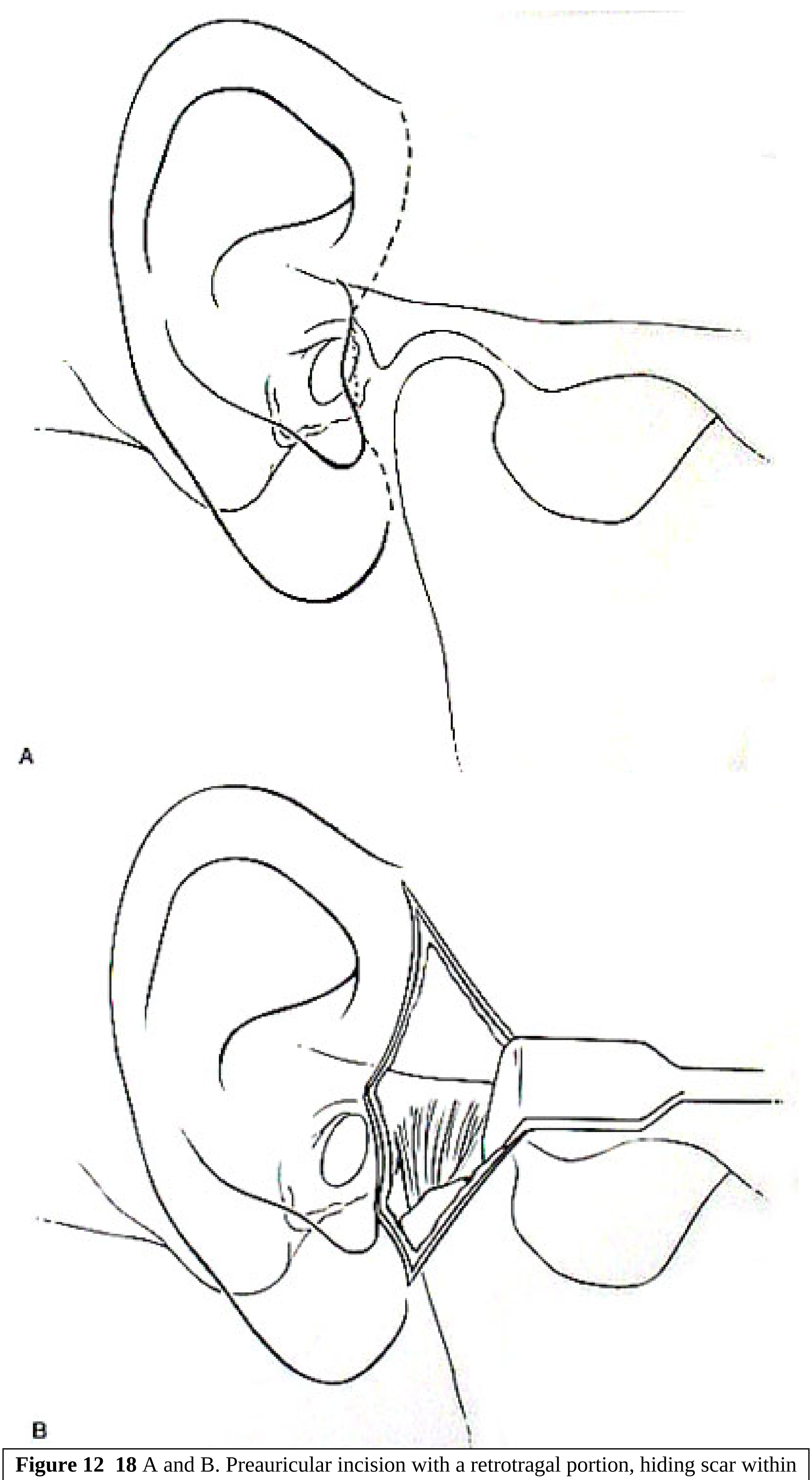
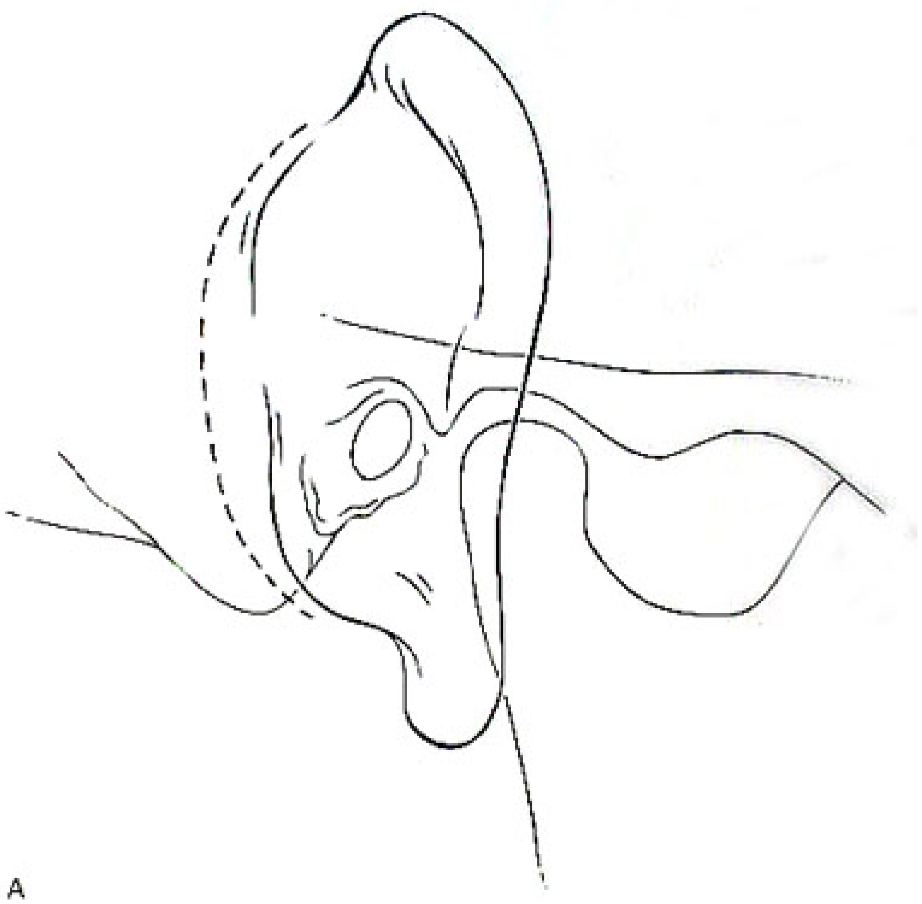
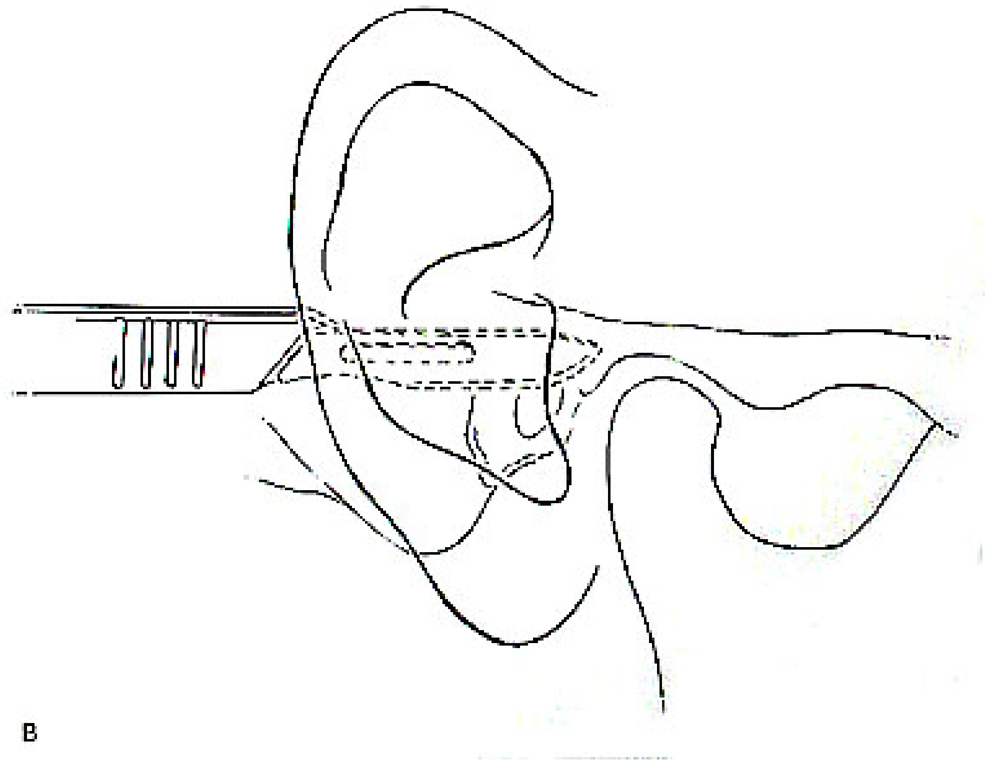


Figure 12 18 A and B. Preauricular incision with a retrotragal portion, hiding scar within the scar.



A



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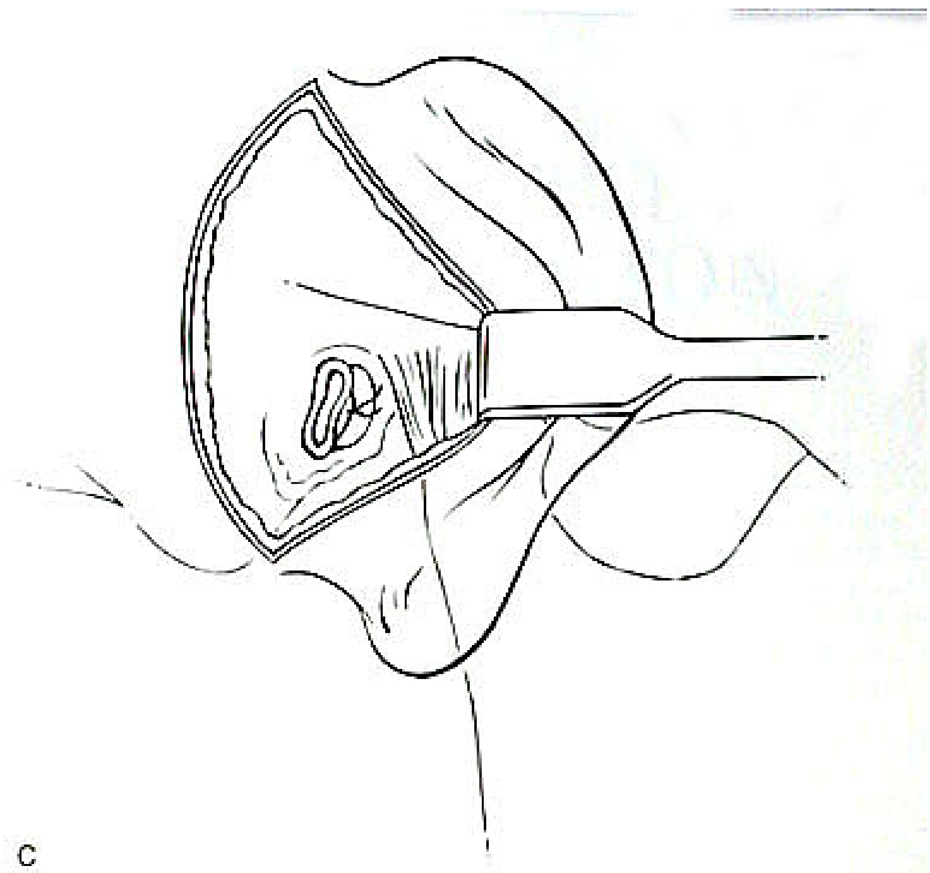

Figure 12 19 Retroauricular approach to the temporomandibular joint (TMJ). A, initial curvilinear incision in the retroauricular crease. B, Transection of the external auditory meatus. C, Retraction of the external ear anteriorly, exposing the TMJ capsule.

REFERENCE

1. Al-Kayat A, Bramley P; A modified pre-auricular approach to the temporomandibular joint and malar arch, Br J Oral Maxillofac Surg *17*:91,1979.