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CHAPTER 11.3

Craniofacial Surgery

Stephen A. Schendel, MD, DDS, FACS
Joseph F. Looby, DO
Tara Cornaby, MD
Richard A. Jaffe, MD, PhD
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Repair of Facial Fractures

Surgical Considerations

Description: Facial fractures are classified by location and the involved bones.

Upper and mid-face region: Frontal sinus fractures may involve the anterior wall alone, or also may involve the nasofrontal ducts and/or posterior wall. Nasofrontal duct disruption may require obliteration of the duct and sinus, which is done with an electric burr and loupe magnification to remove all mucosa before grafting the area with bone, fat, or pericranium. A posterior wall disruption is a fracture into the anterior cranial fossa that may require CSF leak repair ± cranialization of the sinus (complete removal of the posterior wall of the sinus). Each frontal bone forms a large component of the orbital roof and, as such, ocular injury or periorbital entrapment must be considered.

Fractures of the maxilla are classified as **LeFort I, II,** or **III,** depending on the level of the fracture (Fig. 11.3-2). **LeFort I** is a horizontal fracture, separating the teeth and lower maxillary components from the upper facial structures. **LeFort II** is a triangular fracture with a fracture line across the nose, below the infraorbital rims, and extending through the entire lower maxillary structures. **LeFort III** is essentially a disassociation of the cranium and face. In these cases, the maxilla is usually mobile or impacted posteriorly and occasionally closes off the posterior airway. Further mobility of the segments may be present with a sagittal split of the palate. Associated fractures in the maxillary region (Fig. 11.3-2) include fractures of the zygoma; orbital fractures (most commonly orbital floor), isolated nasal fractures; naso-orbital-ethmoid (NOE) fractures (usually with severe comminution of the upper face); and cranial base fractures with the potential for dural tears and CSF rhinorrhea. Added procedures which may be required to complete the repair of these fractures include **local flap closure** of a CSF leak and **primary bone grafting,** usually from cranium or distant sites, such as the ilium, to highly comminuted areas (e.g., NOE, orbital floors).

Lower face: Fractures of the mandible are classified by the type of fracture and location (Fig. 11.3-3), the most common being the subcondylar fracture. Fractures involving the mandibular body, such as a parasymphyseal fracture, may result in unstable mandibular segments. In cases of bilateral mandibular body fractures associated with symphyseal fractures, the mandible can be flail and fall posteriorly in the supine position, allowing the tongue to block off the airway. All of the fractures involving change in occlusion (LeFort maxillary and all mandibular fractures), require reestablishment of a normal occlusion by the application of arch bars and wires also called intermaxillary fixation (IMF). This may be combined with rigid fixation, most commonly internal plates. In some cases, rigid fixation will allow removal of the IMF at the end of the case; in others, IMF may be required for postop healing. Removal of the throat pack prior to final IMF is of paramount importance.

Trismus may be associated with any of the above injuries 2° direct injury to the muscles of mastication, but is more commonly associated with fractures of these muscular attachments (e.g., mandible, zygoma). Associated **dentoalveolar fractures** of the maxilla or mandible may require preop wiring in the ER. The intent is to hold steady those segments with tenuous stability and blood supply. Intubation techniques should avoid displacing these segments. Fractures not involving change in occlusion (e.g., orbital zygomatic, nasal fracture) can be orally intubated. Most fractures with a change in occlusion should be nasally intubated with RAE or 60° curved connector. Exceptions include edentulous segments allowing tube to pass versus edentulous patient with a splint fabricated for oral intubation. Another preop consideration is the amount of blood loss at the scene or in the ER. Facial and scalp vessels can bleed profusely (hypovolemia) and patients may arrive in the OR with both anterior and posterior nasal packs in place (difficult ventilation).

The **surgical approach** depends on the extent of fractures and associated lacerations. Periorbital incisions can be external, on or below the lower eyelid and over the brow, or internal, along the lower eyelid conjunctiva. Upper facial repair may include a bicoronal approach (Fig. 11.3-4) designed to peel the face off the upper facial skeleton via an ear-to-ear scalp incision. Rainey clips are used to minimize scalp bleeding. Of note, periorbital dissection to explore and repair NOE or orbital floor fractures involves some retraction on the globe. This may cause ↓HR and ↓BP via the oculocardiac reflex. The mandible can be approached through external, preauricular or inferior border, or intraoral incisions.

Variant procedure or approaches: Endoscopic approaches are being developed for multiple fracture sites. **Resorbable plates and screws,** especially for pediatric cases, can be applied through the same surgical approaches.

Usual preop diagnosis: Facial trauma

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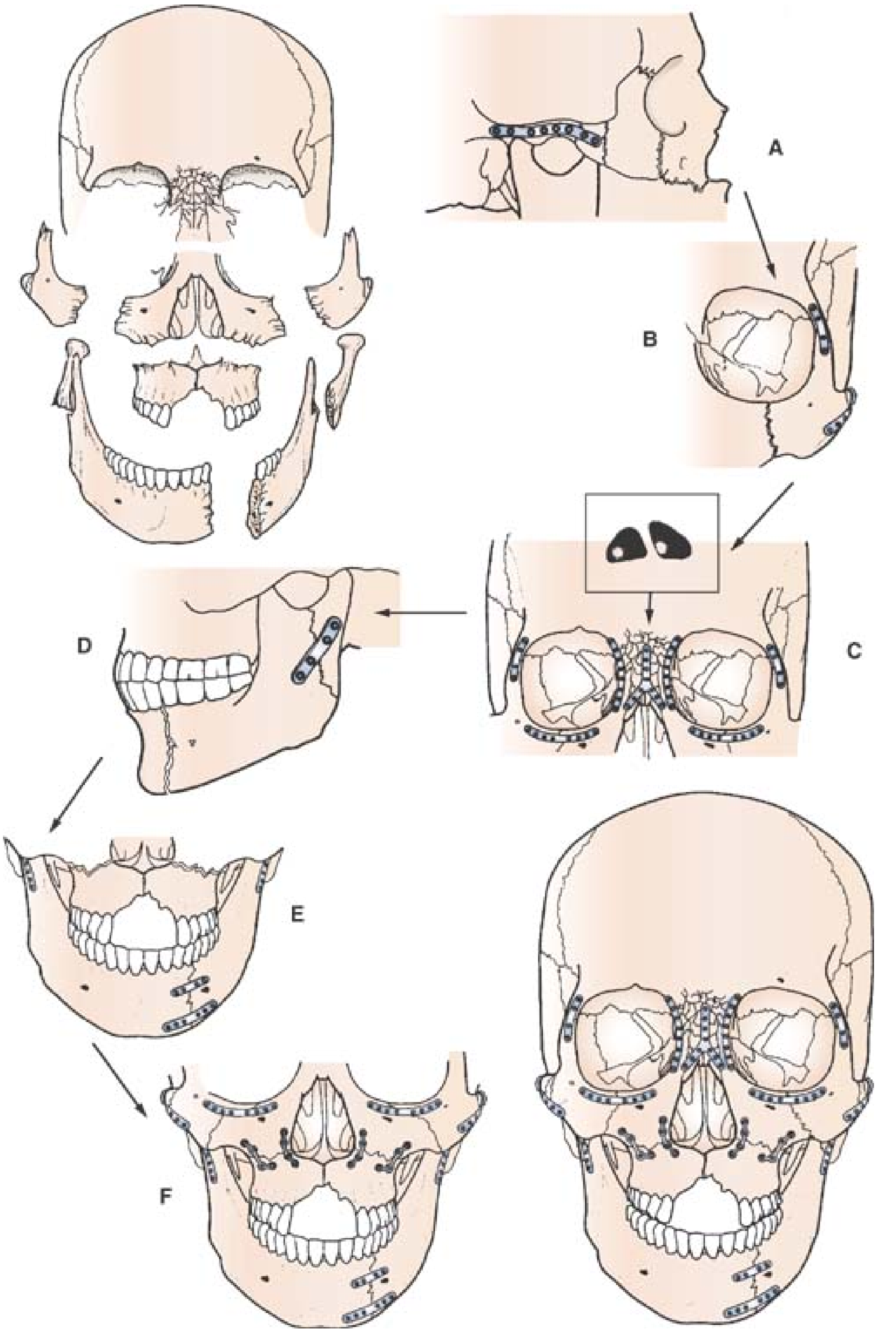

Figure 11.3-1. 1. Panfacial fracture treatment protocol, based on reconstructing load-bearing structures of the facial skeleton. **(A)** Projection of the midface is created by reconstructing the zygomatic arches, starting from the stable part of the temporal bone. **(B)** The zygomas are fixed to the arches and to the frontal bone to create the final projection of the midface. **(C)** The width of the midface is reconstructed by repositioning the central midface (orbits and nose) to its correct position, in relation to the zygomas and frontal bone. Concomitantly, canthopexy is fixed and the frontal bone and sinus fractures are treated. (This procedure is independent of the occlusion.) **(D)** The posterior vertical height of the face is reconstructed by positioning and fixing the condylar fractures. **(E)** Intermaxillary fixation is applied and the

mandible is reconstructed. **(F)** Finally, the LeFort I-level fractures are positioned to natural occlusion. (Reproduced with permission from Booth PW, Schendel SA, Hausamen J-E, eds: *Maxillofacial Surgery.* Churchill Livingstone, Edinburgh: 1999.)

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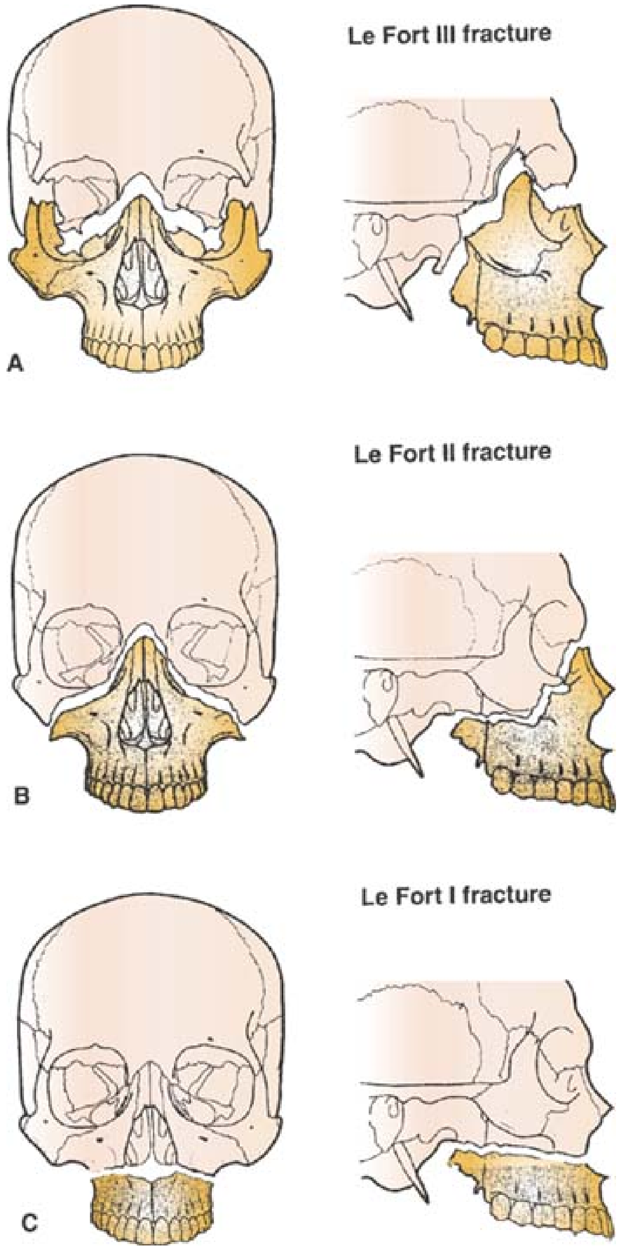

Figure 11.3-2. 2. Schematic of the LeFort fracture lines. **(A)** LeFort III involves separation of cranium from facial bone structure. **(B)** LeFort II is a pyramid-shaped fracture, including the dentition and nasal structures. **(C)** LeFort I is a horizontal fracture involving mobilization of dentition and maxilla. (Reproduced with permission from Booth PW, Schendel SA, Hausamen J-E, eds: *Maxillofacial Surgery.* Churchill Livingstone, Edinburgh: 1999.)

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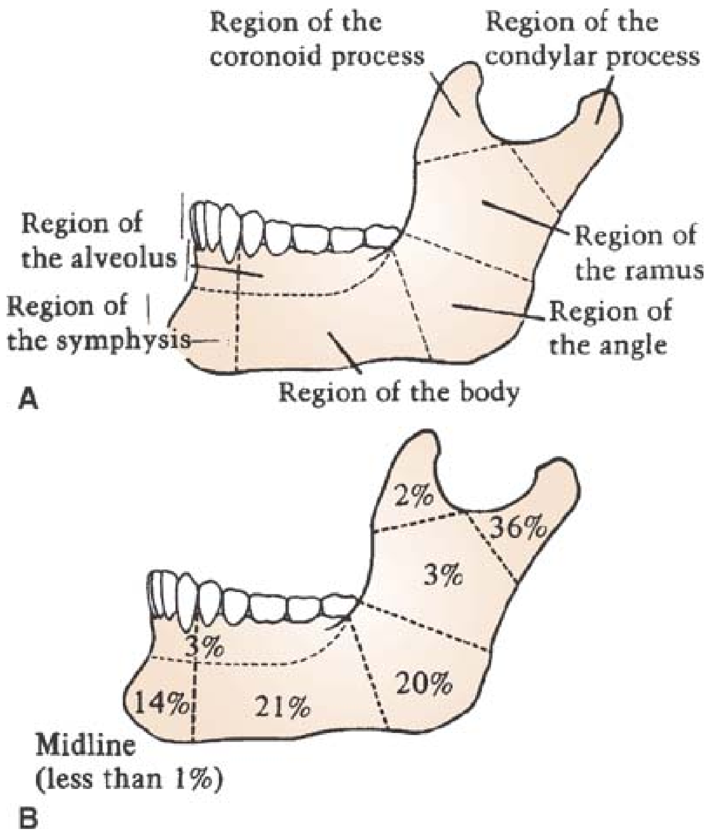

Figure 11.3-3. 3. **(A)** Anatomic regions of the mandible and **(B)** frequency of fractures in those regions. (Reproduced with permission from Aston SJ, Beasley RW, Thorne CH, eds: *Grabb and Smith's Plastic Surgery,* 5th edition. Lippincott-Raven, Philadelphia: 1997.)

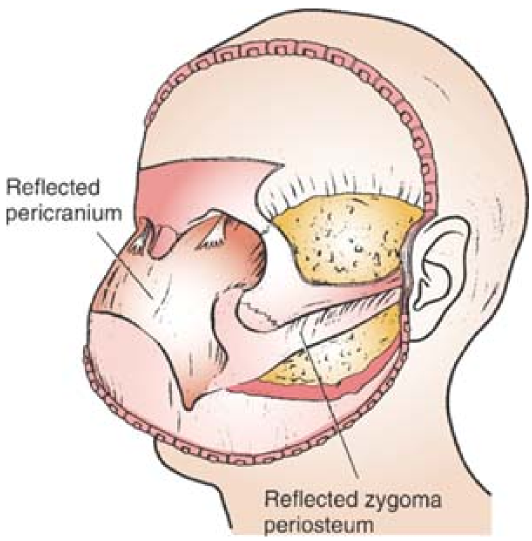

Figure 11.3-4. 4.
Bicoronal approach. (Reproduced with permission from Booth PW, Schendel SA, Hausamen J-E, eds: *Maxillofacial Surgery.* Churchill Livingstone, Edinburgh: 1999.)

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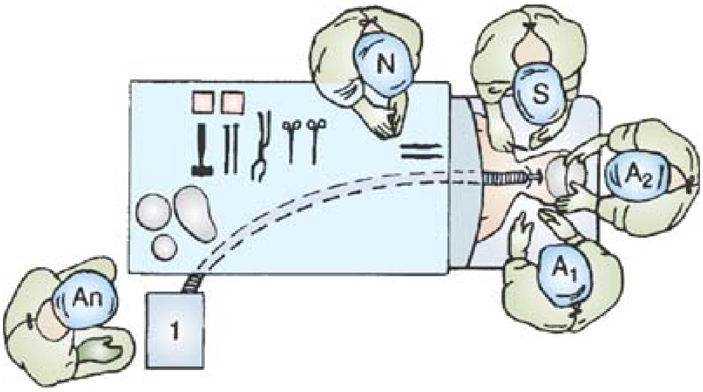

Figure 11.3-5. 5. Standard anesthesia and surgical setup for a maxillofacial surgical procedure and certain craniofacial surgical procedures. The table may be rotated 90°–180° with anesthesia equipment and personnel at the foot or off to one side. (Reproduced with permission from Bell WH, ed: *Modern Practice of Orthognathic Surgery,* Vol I. WB Saunders, Philadelphia: 1990.)

Summary of Procedures

	Mandibular	**Maxillary Orbital/Zygomatic**	**Nasal**
Position	Supine		
Incision	Intraoral; lateral, submandibular	Intraoral, ± subciliary; possibly coronal	Closed reduction; possibly intranasal
Special instrumentation	Air power tools; plate fixation; headlight	+ Periorbital malleable retractors; Rowe disimpaction forceps; acrylic dental split	
Unique considerations	Nasal RAE (sutured to dentition or septum); throat pack; corticosteroids periop to ↓ edema.	Panfacial smash; airway swelling associated with head injury; burns or other system involvement. Consider preop tracheostomy. Close monitoring for and removal of stimulus until oculocardiac reflex recovery.	—
Antibiotics, etc.	Cefazolin 1 g iv	+ Methylprednisolone 125 mg iv (adults)	
Surgical time	1–3 h	1–6 h (bicoronal approach adds 1.5 h)	1 h
Closing considerations	NG at end of procedure, maintained for 24 h; IMF postop; **NB:** throat pack removal.		—
EBL	100–800 mL, depending on extent of fractures, need for graft harvest, patient age		
Postop care	Airway or respiratory status may be compromised (preop and postop swelling/aspiration/associated injuries), requiring maintenance of intubation → ICU.		
Mortality	Minimal (↑ due to associated injuries and blood loss)		
	Trismus		– –

Morbidity	Poor occlusion Drooling Poor cosmetic result Chronic pain/sensation changes Loss of taste	Loss of smell Visual problems/epiphora Sinus problems Breathing difficulty	– –
Pain score	4–8	4–8	4–8

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Patient Population Characteristics

Age range	> 4 yr
Male:Female	1:1 (varies by age group)
Incidence	The most common are: nasal bones, zygoma and arch, mandible, and orbital floor (on the rise due to airbags in autos).
Etiology	**Adults:** Motor vehicle accidents (MVAs), mostly young males (43–67%); assaults (13–48.8%); sports-related (3.8%); falls (3.6%); gunshot wounds (3%) **Children:** Uncommon: only 5% of all facial fractures occur in ages < 12 yr; falls (33%); MVA (28%); abuse (3%); dog bites (rare). 69% are periorbital or nasal.
Associated conditions	Airway compromise/closed head trauma (40%); extremity fractures (33%); thoracic injury (29%); open or radiographic brain injury (25%); intraabdominal (12%); globe injuries (11%); oral trauma (11%); pelvic fractures (10%); C-spine fractures (4–10%); T-L spine injuries (4%); shock; multisystem trauma; burns; massive soft-tissue loss. Mandibular fractures during MVAs are associated with a 65% incidence of life-threatening injuries and mortality of up to 8%; up to 1/3 of LeFort fractures will require intubation, most often due to upper respiratory tract blood and secretions.

Anesthetic Considerations

Preoperative

The forces required to produce facial fractures are considerable and frequently result in other associated trauma (e.g., closed head trauma; spine injuries; thoracic injury, including pneumothorax and myocardial contusion; intraabdominal bleeding). Soft-tissue injury to the tongue or larynx can make airway management difficult. When in doubt, a tracheostomy under local anesthesia or awake intubation should be considered. In mandible or maxillary fractures, nasal intubation is usually best, because the patient will be placed in intermaxillary fixation (IMF) (teeth brought together via wires or rubber bands) at the conclusion of the procedure. In malar or nasal bone fractures, the fixation may be precarious, making it undesirable to use mask ventilation at the termination of the procedure and necessitating awake extubation. Facial nerve monitoring may be required, contraindicating the use of muscle relaxants.

Frequently, the anesthesiologist's first encounter with these patients is in the ER, where prompt airway management decisions are essential—often before diagnostic imaging studies are complete. These patients should be treated with full-stomach precautions (see p. B-4) and may have already aspirated. Patients may be unable to open their mouths 2° pain or mechanical factors. The cause of limited mouth opening should be determined before induction of anesthesia. Several options exist. Often, the airway can be managed simply by inserting an oropharyngeal airway; failing this, an emergency intubation will be necessary. Blind nasal intubation should be avoided in patients with CSF rhinorrhea or other evidence of nasopharyngeal trauma, where the potential for

ISBN: 0-7817-6670-2 | 4th_Edition
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creating false passages and additional trauma is significant. An awake oral intubation with topical anesthesia is often the safest approach. Emergency oral *(Print pagebreak 1110)* intubation may be complicated by an unstable C-spine and limited jaw opening, together with blood and debris in the oropharynx, making visualization difficult if not impossible. Often the only recourse is tracheostomy under local anesthesia. As with any trauma victim, attention is first directed toward maintaining the airway and restoration of fluid volume. The repair of the facial fracture may be carried out incidental to the primary trauma surgery or, more often, is deferred until the patient's condition is stabilized. This preop assessment will focus on the patient coming to the OR for semielective repair of a facial fracture.

Airway	**Semielective:** Usually, facial swelling and intraoral bleeding will have resolved, although mouth opening may be limited 2° pain or mechanical factors. Airway management requires knowledge of the fracture site(s). Patients with a maxillary fracture may benefit from an oral intubation to allow inspection of the nasopharynx before nasal intubation and definitive repair. The possibility of an awake fiber optic intubation (see p. B-5) should be discussed with the patient. Patients with an isolated orbital, zygomatic, or nasal fracture usually do not present airway management problems. The surgeon should be consulted regarding the preferred intubation route. **Trauma:** Airway and nasal obstruction following trauma can be extreme, as a result of soft-tissue swelling and accumulated blood and secretions. The extent of facial fractures, particularly in the midface, should be identified as they may preclude nasal intubation. Mandibular fractures may make access to the oropharynx difficult. Unstable dentoalveolar fractures may require preop wiring in the ER. In the case of massive trauma to the face, urgent tracheostomy should be considered. **Tests:** As indicated from H&P.
Respiratory	**Trauma:** Evaluate for associated trauma and respiratory insufficiency 2° aspiration. that chest tubes are functioning properly. **Tests:** CXR; others as indicated from H&P.
Cardiovascular	**Semielective:** Typically, several days will have elapsed since the initial trauma, and the patient should be hemodynamically stable. **Trauma:** Blunt chest trauma may be associated with myocardial contusion, pericardial effusion/tamponade, and aortic tear/dissection. **Tests:** ECG; others as indicated from H&P.
Neurological	**Semielective:** Document any neurological deficits and altered mental status. Meningitis may occur in patients with persistent CSF rhinorrhea or pneumocephalus. **Trauma:** Intracranial injury may be associated with facial fractures. Patients with head trauma may have ↑ ICP; therefore, appropriate methods (e.g., CO_2↓, fluid ↓, smooth induction/intubation) are used to prevent further ↑ ICP. Basilar skull fractures preclude passage of nasotracheal and NG tubes. In the presence of otorrhea or rhinorrhea, positive-pressure mask ventilation is inadvisable, due to the potential for causing pneumocephalus. **Tests:** Review skull and C-spine x-rays.
Musculoskeletal	**Semielective:** May be associated with other fractures and soft-tissue trauma that may affect patient positioning. **Trauma:** C-spine injuries are commonly associated with facial injuries. The C-spine should be cleared by clinical and x-ray exam before transport to OR. If C-spine cannot be cleared, intubation should be done with the head in a neutral position (splinted or with axial traction), using direct FOL (see p. B-5).

Hematologic	**Trauma:** Maxillary surgery may be associated with major blood loss and, for elective cases, autologous donation should be encouraged. **Tests:** Hct; others as indicated from H&P.
Laboratory	Other tests as indicated from H&P.
Premedication	Standard premedication (see p. B-1) is appropriate for nontrauma, neurologically intact patients with normal airways. **Trauma:** Trauma patients should be considered to have full stomachs, and sedative premedications are best avoided. Aspiration prophylaxis with 0.3 M Na citrate (30 mL po), ± metoclopramide 10 mg iv ± ranitidine 50 mg iv, should be considered.

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Intraoperative

Anesthetic technique: The majority of patients presenting for elective procedures are healthy and have normal airways. In the case of facial trauma, however, intubation of the trachea may be impossible. Hence, a tracheostomy under local anesthesia may be life-saving.

Induction	If there is any doubt regarding the ease of intubation, an awake FOL should be performed (see p. B-5). Nasal intubation is preferred for patients with mandibular and maxillary (LeFort) fractures involving a change in occlusion. Patients with orbital, zygomatic, or nasal fractures usually are intubated orally. In patients with normal airways, a standard induction (see p. B-2) is appropriate. Nasal or oral ETTs (RAE), or anode ETTs are commonly used to minimize intrusion into the surgical field.	
Maintenance	Standard maintenance (see p. B-2); muscle relaxation usually is required except with facial nerve monitoring. Controlled ↓ BP may be appropriate. Administration of an antiemetic (e.g., metoclopramide 10–20 mg iv and ondansetron 4 mg iv) is beneficial in patients who have their jaws wired or banded together.	
Emergence	Patients with difficult airways or with jaws wired together should be extubated when fully awake. Extubation over a tube-changer may be appropriate. A wire cutter (or scissors for elastic bands) should be at the bedside at all times. Ensure that all throat packing has been removed before extubation. Thorough oropharyngeal suctioning is essential. NG tube may be used postop, so consider placement prior to extubation. Some patients with multiple trauma or extensive soft-tissue swelling may require continued postop intubation and mechanical ventilation.	
Blood and fluid requirements	Moderate - large blood loss iv: 16–18 ga × 1–2 **Trauma:** NS/LR @ 6–8 mL/h **Other:** NS/LR @ 2–4 mL/h	Blood loss from facial fractures or orthognathic procedures can be extensive. T&C patient so blood is immediately available in OR.
Monitoring	Standard monitors (see p. B-1). ± Arterial line	Invasive monitoring may be required in patients with intracranial or other trauma, or for controlled ↓ BP. Muscle relaxants will interfere with facial nerve monitoring.
Control of blood loss	Surgical hemostasis	Surgical hemostasis should control most bleeding in these procedures.
	Topical vasoconstrictors	Topical vasoconstrictors, such as phenylephrine or cocaine, can be applied on the surgical field.
	Posterior oropharyngeal packing	Posterior oropharyngeal packing can keep blood from passing undetected into the upper GI tract.
	Controlled ↓ BP	Controlled ↓ BP often can be achieved simply by increasing volatile anesthetic levels.

Positioning	and pad pressure points. eyes.	Some surgeons prefer that the OR table be rotated 90° or 180°. Be prepared with long hoses and appropriate connectors. Protect eyes with an ophthalmic ointment.
Complications	ETT damage	Nasal ETT may be wired inadvertently to the maxilla, making extubation difficult. In case of ETT damage, be prepared to reestablish the airway rapidly by reintubation, usually over an intubating stylet or gum elastic bougie.
	Oculocardiac reflex	Notify surgeon (stop surgical stimulus). Consider atropine and increasing depth of anesthesia.

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Postoperative

Complications	Airway obstruction	Wire cutters (or scissors) should be available at bedside to facilitate emergent reintubation or other form of airway management. Consider retained throat pack.
	PONV	Multimodal treatment of nausea is important.
Pain management	Parenteral narcotics (see p. C-3) or PCA with antiemetics (see p. C-3).	Local anesthetic infiltrated at end of procedure.

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Lefort Osteotomies

Surgical Considerations

Description: LeFort osteotomies are used to correct maxillary deformities. The most common is the **LeFort I,** a transverse osteotomy, above the apices of the teeth, used to correct maxillary retrusion or maxillary vertical excess or deficiency. One of the goals in achieving improved function is to improve the occlusion, as classified by Angle (Fig. 11.3-6). One or both jaws may be moved to achieve normocclusion. An intraoral vestibular incision is used for this approach, followed by an osteotomy of the maxilla, with either a burr or a saw, and completed with osteotomes. The osteotomy extends through the maxillary sinus toward the ETT, within the piriform aperture. There is potential for nasal ETT damage with this maneuver. Of note, BP usually will increase at the start of the osteotomies, increasing bleeding if anesthesia/analgesia is inadequate. The maxilla is subsequently downfractured (Fig. 11.3-7) and mobilized with Rowe disimpaction forceps. This is when most of the bleeding occurs. Further interdental osteotomies creating multiple maxillary segments may be required. **LeFort II** or **LeFort III** maxillary osteotomies may be used to correct severe midfacial retrusion. In these cases, infraorbital incisions are used with either brow or coronal (Fig. 11.3-4) incisions. With maxillary advancements, iliac or cranial bone grafts are often necessary to close the bony gap created. Most of these patients have orthodontic appliances and will require *(Print pagebreak 1113)* intermaxillary fixation (IMF), with either wire or elastics at the end of the procedure, with or without a prefabricated splint. The maxilla is fixed rigidly in the new position with miniplates.

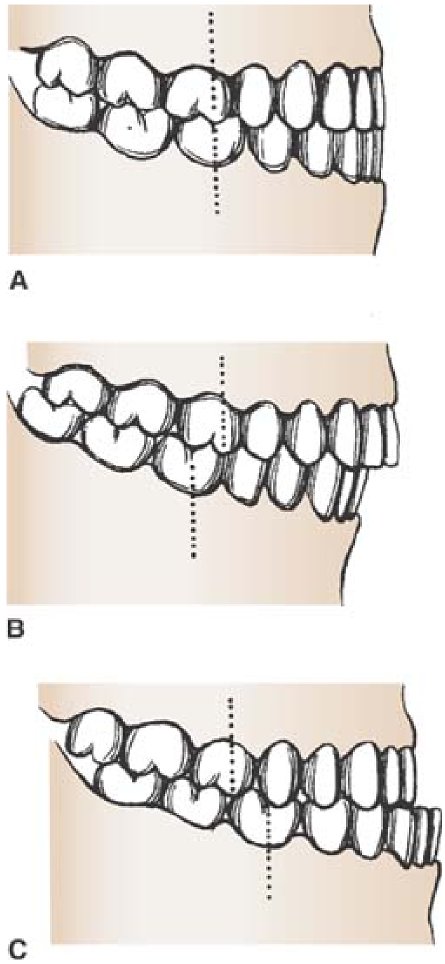

Figure 11.3-6. 6. The Angle classification of occlusion. **(A)** Class I, normal occlusion. **(B)** Class II, retroocclusion or mandibular deficiency. **(C)** Class III, prognathic occlusion (maxillary deficiency or mandibular excess). The key relationships to be discerned are those of the first molar teeth, cuspids, and incisors. (Reproduced with permission from Aston SJ, Beasley RW, Thorne CH, eds: *Grabb and Smith's Plastic Surgery,* 5th edition. Lippincott-Raven, Philadelphia: 1997.)

Variant procedure or approaches: Recently, **distraction osteogenesis** after LeFort osteotomy has been shown to be effective for correction of severe deformity that would be difficult to correct with single movements and internal fixation. This technique creates new bone as the osteotomized bones are slowly separated. No bone grafts are necessary. Distraction hardware is applied either internally or externally. External devices are stabilized via halo and compression bolts into the skull. IMF is not indicated, as the upper jaw must be free to be distracted in relation to the lower jaw. A second operation may be required for removal of distractor hardware. **Absorbable internal devices** also are available.

Usual preop diagnosis: Facial deformities; dentoskeletal dysplasia

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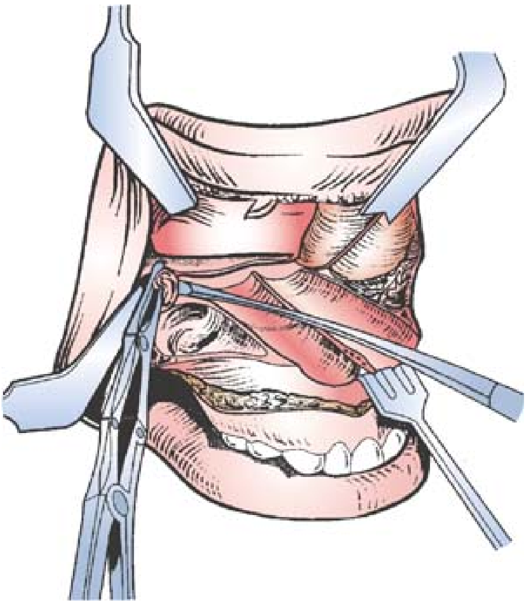

Figure 11.3-7. 7. Removal of bone around the perpendicular plate of the palatine bone. The descending palatine vessels may be ligated. (Reproduced with permission from Booth PW, Schendel SA, Hausamen J-E, eds: *Maxillofacial Surgery.* Churchill Livingstone, Edinburgh: 1999.)

Summary of Procedures

	LeFort I	LeFort II	LeFort III	Distractor
Position	Supine; table may be rotated 90° or 180°			
Incision	Intraoral	Intraoral and facial ± coronal		
Special instrumentation	Miniplates and screws; burr or saws			Distractors
Unique considerations	Jaw frequently closed (wires or elastic); nasal RAE or armored tube. * **NB: Keep SBP < 100 mmHg during osteotomy-closure.** With cranial bone graft harvest, the nasal ETT goes opposite to the donor side and is repositioned later.			No IMF
Antibiotics, etc.	Cefazolin 1 g iv; methylprednisolone 125 mg iv (adults)			
Surgical time	3–6 h			
Closing considerations	***NB: Throat pack removal.** NG at end of case × 24 h. NSAIDs contraindicated.			
EBL	400–800 mL			
Postop care	PACU → room	ICU × 1 d		
Mortality	Rare			
	Relapse Infection			

Morbidity	Bone/tooth loss: Uncommon Severe intraop bleeding: Uncommon Blindness: Very rare Temporomandibular joint dysfunction Nasal obstruction Nasolacrimal obstruction Oronasal fistulas (multi-piece osteotomies, uncommon) Poor cosmetic result Sensory nerve dysfunction			Distractor malfunction
Pain score	4	5	5	5

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Patient Population Characteristics

Age range	15 yr–adulthood, usually < 30 yr
Male:Female	1:1
Incidence	Up to 5% of population
Etiology	Usually developmental in nature; also cleft lip and palate patients Rarely syndromic: Apert (1/100,000); Crouzon (1/25,000)
Associated conditions	Usually none with developmental cases; sleep apnea; or part of a recognized condition associated with congenital anomalies (e.g., cleft lip and palate, proptotic eyes, severe mitten-hand syndactylies)

Anesthetic Considerations

See Anesthetic Considerations following Mandibular Osteotomies/Genioplasty, p. 1119.

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Mandibular Osteotomies/Genioplasty

Surgical Considerations

Description: Mandibular deformities include either a retruded mandible or a prognathic mandible involving a malocclusion (Class II or III), and may occur in combination with a small chin (microgenia). Surgical correction of the basic mandibular deformity involves either advancing or retruding the mandible. The most common procedure for this is the **sagittal ramus split osteotomy (Obwegesser)** (Fig. 11.3-8). The mandible is split with the inferior alveolar nerve solely within the anterior segment, such that the tooth-bearing anterior segment can slide forward or backward to correct the original deformity. A variety of other techniques of mandibular osteotomies exist, often involving the ramus area of the mandible, and are performed via an intraoral approach.

In some very large deformities, an external incision (**Risdon** type) and bone graft placement may be necessary to complete the mandibular ramus reconstruction. Many patients will be treated for dentoskeletal deformities with a combination of LeFort movement and sagittal-split osteotomies of the mandible. When the mandible is set back, mandibular bone is resected and often can be used in combined procedures as bone graft for the LeFort osteotomy. This avoids cranial bone harvest and, therefore, avoids repositioning the ETT during the procedure for cranial bone access and avoids donor site morbidity. Occasionally, deformities may be corrected by mandibular body osteotomies.

Rigid fixation of mandibular osteotomies is often accomplished by the use of small miniplates and screws. Fixation also can be accomplished with elastic traction (rarely, wire fixation) between mandible and maxilla (IMF), placed either at the time of surgery, or several days following, and held in position for 1–2 wk. These procedures may be *(Print pagebreak 1117)* combined with a **genioplasty** to correct the chin deformity; or, genioplasty may be performed as an isolated procedure. The most common type is a horizontal osteotomy of the inferior mandible, with the chin segment repositioned with internal fixation (Fig. 11.3-9A). Augmentation of the chin also is accomplished with alloplastic onlay materials (Fig. 11.3-9B) placed via either the oral route or the extraoral route through a small submental incision. As an isolated procedure, genioplasty is performed most frequently with local anesthesia and sedation.

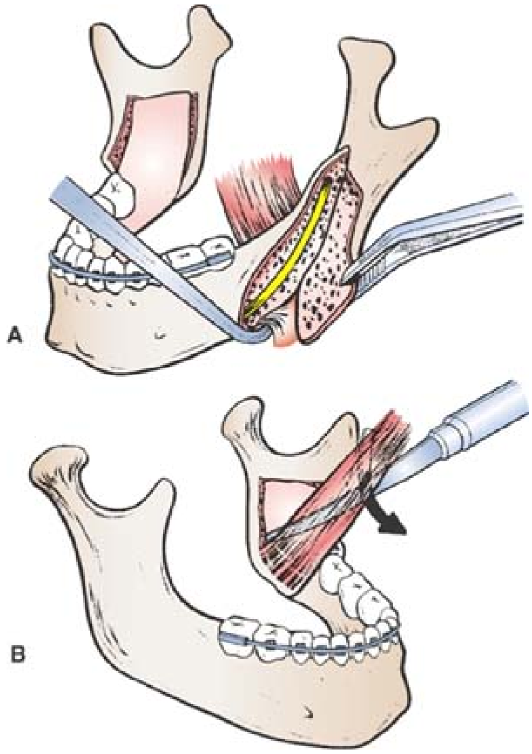

Figure 11.3-8. 8. (A, B) "J" stripper used to remove muscle attachments from medial aspect of distal segment. Used through the osteotomy split. (Reproduced with permission from Booth PW, Schendel SA, Hausamen J-E, eds: *Maxillofacial Surgery.* Churchill Livingstone, Edinburgh: 1999.)

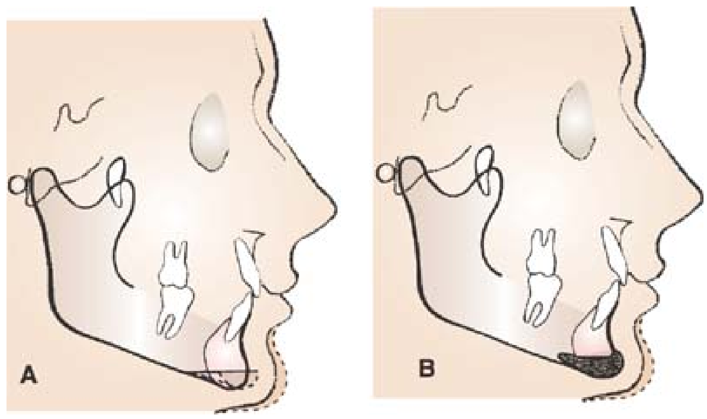

Figure 11.3-9. 9. An osseous genioplasty **(A)** can be used to augment the chin, move it posteriorly, alter its vertical position or change the transverse position of the chin. Allopastic implants **(B)** can be used to augment the chin anteriorly. These are less effective for vertical augmentation. (Reproduced with permission from Booth PW, Schendel SA, Hausamen J-E, eds: *Maxillofacial Surgery.* Churchill Livingstone, Edinburgh: 1999.)

Variant procedure or approaches: Distraction osteogenesis is being used more frequently in treating certain acquired and congenital jaw deformities. This involves a partial mandibular osteotomy and placement of a distraction device (Fig. 11.3-10). Depending on the application, this may be an external or internal device. External devices are visible over the skin with percutaneous pins into the bone. Internal devices are placed beneath the oral soft tissues, with a single adjustment pin exposed.

Usual preop diagnosis: Mandibular deformity

Summary of Procedures

Position	Supine; table may be rotated 90° or 180°. Nasal RAE tube toward head of bed (sutured through nasal septum), padded, and secured to forehead; shoulder roll; neck extended

Incision	Usually oral, but may be external in the submental or posterior mandibular area; preinjection with local anesthetic with epinephrine
Special instrumentation	Miniplates and screws; burrs/saws; osteotomes; distractor for distraction osteogenesis; throat pack
Unique considerations	Scleral lubricant and shields needed. Postop, patient may have IMF with inability to open the mouth. (IMF not used with distractor cases. ***NB: Remove throat pack** before extubation; thorough oro- and nasopharyngeal suction.
Antibiotics, etc.	Cefazolin 1 g iv; methylprednisolone 125 mg iv (adults)
Surgical time	Genioplasty: 0.5–1 h Mandibular osteotomy: 2–4 h
EBL	Genioplasty: 50 mL Mandibular osteotomy: 100–200 mL
Postop care	PACU → room. If sleep apnea present, ICU overnight + extubation.
Mortality	Rare
Morbidity	Mandibular relapse: ≥ 30% Mental nerve paresthesia: 5–20% Lingual nerve injury: 1–16% Infection/nonunion: < 1% Facial nerve injury: Rare (most reported cases resolve without treatment) Aseptic necrosis (buccal plate or genioplasty fragment) Worsening TMJ problems Adverse cosmetic result
Pain score	4

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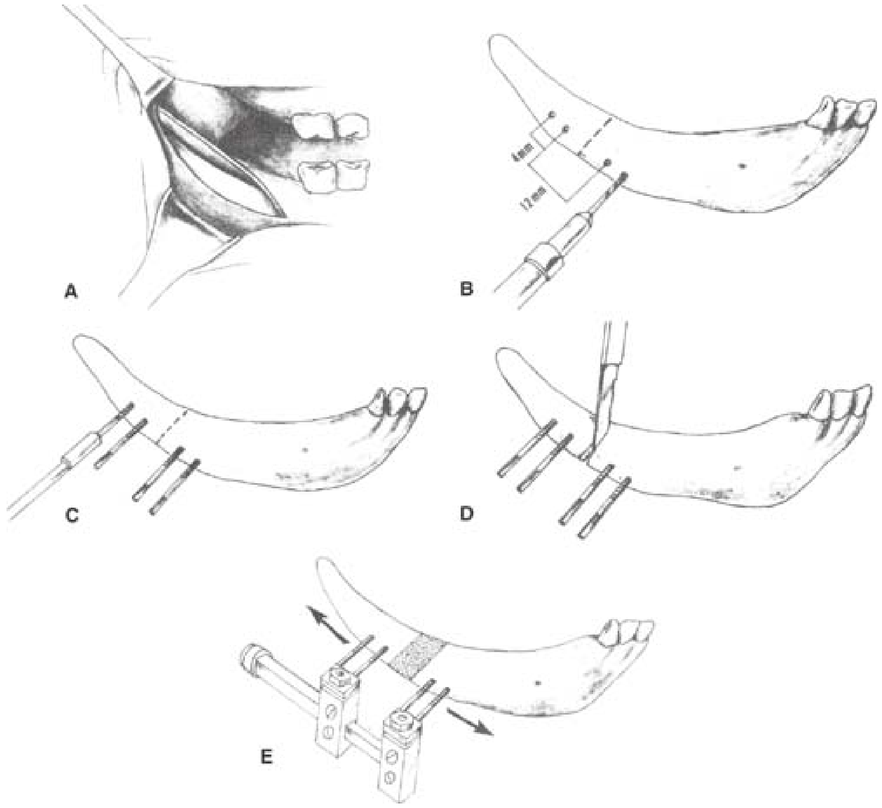

Figure 11.3-10. 10. Mandibular distraction technique: **(A)** An intraoral incision is made along the oblique line of the mandibular remnant. **(B)** Sites of the pinholes and proposed osteotomy (interrupted line). **(C)** Pins have been inserted. **(D)** The osteotomy is performed. **(E)** Commencement of distraction with the appliance in position. The arrows

designate the movement of the mandibular segments with formation of bony regenerate in the resulting gap. (Reproduced with permission from Aston SJ, Beasley RW, Thorne CH, eds: *Grabb and Smith's Plastic Surgery,* 5th edition. Lippincott-Raven, Philadelphia: 1997.)

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Patient Population Characteristics

Age range	Infant–adult
Male:Female	Unknown
Incidence	Unknown
Etiology	Developmental (90%); acquired (10%)
Associated conditions	Usually none with developmental cases; sleep apnea; congenitally small mandible may be associated with a large tongue and cleft palate (Pierre Robin syndrome), hemifacial microsomia (which may be associated with heart, vertebral, and other anomalies), Treacher Collins syndrome, or Nager's syndrome (many of the congenital cases may be tracheostomy- and gastrostomy-dependent, with associated TMJ ankylosis).

Anesthetic Considerations

(Procedures covered: LeFort osteotomies; mandibular osteotomies; genioplasty)

Preoperative

These surgeries are usually performed on patients with facial disproportion. In general, this patient population is young and healthy; however, many of them will present with challenging airway management problems. In addition, facial disproportion will often accompany congenital anomalies (e.g., Crouzon, Apert, Pierre Robin, and Treacher Collins syndromes). (For discussion of specific syndromes, see Anesthetic Considerations for Pediatric Orthopedic Surgery of the Pelvis and Lower Limbs, p. 1389).

Airway	As usual, a careful airway evaluation is essential since many of these patients have abnormal airway anatomy and may be difficult to mask ventilate or intubate. Visual inspection often reveals the reasons for the surgery and allows the anesthesiologist to determine the safest approach to intubation. When a difficult intubation is anticipated, the need for awake fiber optic intubation (see p. B-5) should be discussed with the patient.
Respiratory	Consider the anesthetic implications of associated congenital syndromes in this patient population. Obstructive sleep apnea (OSA, see p. 255) also may be associated with patients in need of mandibular surgery. **Tests:** As indicated from H&P.
Cardiovascular	As above, consider the implications of possible congenital syndromes. Assess whether patient is a suitable candidate for the use of controlled ↓ BP, particularly those undergoing maxillary procedures. **Tests:** As indicated from H&P.
Hematologic	Encourage autologous blood donation for maxillary procedures. **Tests:** Hct
Laboratory	Other tests as indicated from H&P.
Premedication	Standard premedication (see p. B-1) is usually appropriate.

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Intraoperative

Anesthetic technique: GETA

Induction	If there is any doubt regarding the ease of intubation or ability to mask ventilate, an awake FOL should be performed (see p. B-5). Nasal intubation is preferred for patients undergoing mandibular or maxillary osteotomies, as well as genioplasty. In patients with normal airways, a standard induction (see p. B-2) is appropriate. Nasal or oral ETTs (RAE), or anode ETTs, are commonly used to minimize intrusion into the surgical field.	
Maintenance	Standard maintenance (see p. B-2); muscle relaxation is usually required. Administration of an antiemetic (e.g., metoclopramide 10–20 mg iv and ondansetron 4 mg iv) is essential in patients who have their jaws wired or banded together.	
Emergence	Patients with difficult airways or with their jaws wired (or banded) together should be extubated when fully awake. Perform thorough oropharyngeal suctioning. If not placed previously, an NG tube should be placed before extubation. A wire cutter (or scissors for elastic bands) should be at the bedside at all times. Ensure that all throat packing has been removed before extubation.	
Blood and fluid requirements	Moderate - large blood loss iv: 16–18 ga × 1–2 NS/LR @ 5–8 mL/kg/h	Maxillary osteotomies may be associated with major blood loss (e.g., 1500–2000 mL). The majority of blood loss occurs when the maxilla is downfractured. Controlled ↓ BP (SBP < 90 mmHg) may be particularly useful during this part of the case, and blood should be readily available for this and all maxillary procedures.
Monitoring	Standard monitors (see p. B-1). ± Arterial line ± CVP line or 2nd iv	Direct arterial pressure measurements are useful for deliberate ↓ BP. Central venous access or a 2nd peripheral iv may be useful for vasodilator infusions.
Positioning	and pad pressure points. eyes.	Eyes should be protected with an ophthalmic ointment and possible tarsorrhaphy by the surgeons. Some surgeons prefer to have the OR table rotated 90° or 180°. Be prepared with circuit-extension tubing.
Complications	ETT damage Hemorrhage	ETT may be cut during maxillary osteotomy, necessitating rapid reintubation.

Postoperative

Complications	Airway obstruction	Wire cutters (or scissors) should be available at bedside to facilitate emergent reinduction or other form of airway management. Consider retained throat pack.
	PONV	Multimodal treatment of nausea is important.
Pain management		Parenteral narcotics (see p. C-2) or PCA with antiemetics (see p. C-3).

Suggested Readings

1. Blanco G, Melman E, Cuairn V et al: Fibreoptic nasal intubation in children with anticipated and unanticipated difficult

intubation. *Paediatric Anaesthesia* 2001; 11(1):49–53.

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6. Morris DE, Lo LJ, Margulis A: Pitfalls in orthognathic surgery: avoidance and management of complications. *Clin Plast Surg* 2007; 34(3):e17–29.

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11. Silva AC, O'Ryan F, Poor DB: Postoperative nausea and vomiting (PONV) after orthognathic surgery: a retrospective study and literature review. *J Oral Maxillofac Surg* 2006; 64(9):1385–97.