Oral & Maxillofacial Surgery

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Introduction

Oral & Maxillofacial Surgery (OMFS) is a unique surgical speciality which emerged from the World Wars through treatment of the facial injuries encountered by service personnel. These injuries necessitated adequate repositioning of the teeth by dental surgeons to re-establish normal form and function of the facial bones. As the speciality evolved and the spectrum of surgery broadened, medical training (as a second degree) became mandatory. Modern day OMFS focuses on eradicating infective, benign and malignant diseases of the head and neck, and restoring normal form and function of the dentition and facial bones following trauma or deformity. It requires a wide skill base, which harnesses aspects from a number of different surgical specialities in order to treat disease.

This chapter will focus on some basic anatomy and core operations that you are likely to see, along with some tips to ensure that you make the most out of your rotation.

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Core Knowledge

The intricate anatomy of the head and neck is beyond the scope of this book, but the diagrams included encompass the basics in order to better understand the nature of the surgery involved (Fig. 16.1).

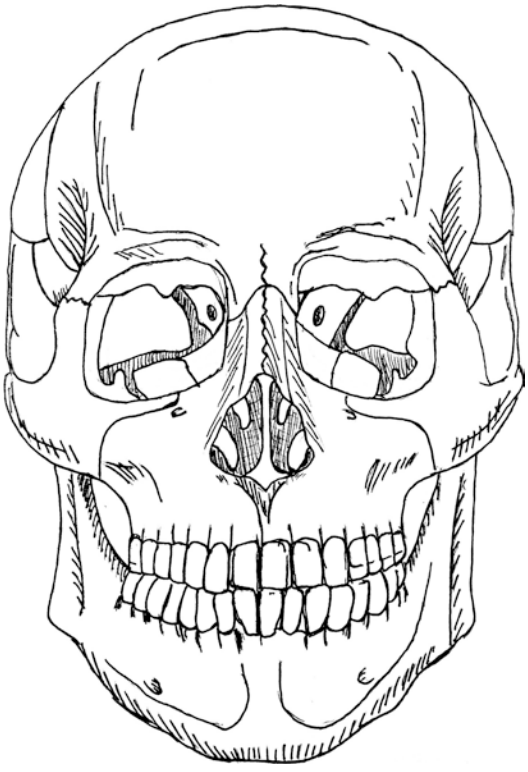

Fig. 16.1 Image of skull – frontal view

R.A. Fisher et al. (eds.), *Introduction to Surgery for Students*, DOI 10.1007/978-3-319-43210-6_16

The Le Fort Classification

One of the main classifications utilised to describe maxillofacial trauma is the Le Fort Classification. This was devised by a French surgeon who struck cadavers with a cannon ball to observe any reproducible fracture patterns and eventually describing three fracture patterns (Fig. 16.2).

Le Fort I

This is a horizontal maxillary fracture resulting in the tooth-bearing maxilla being detached from the midfacial skeleton. The fracture line passes above the teeth, but below the zygomatic processes.

Le Fort II

This is a pyramid-shaped fracture with the nasofrontal sutures at the apex and maxilla forming the base. The fracture extends through the posterior tooth-bearing segment of the maxilla, nasal bones and orbital floors.

Le Fort III

Also known as craniofacial disjunction, the fracture results in separating the middle third of the face from the cranial vault. The fracture lines extend more laterally than Le Fort II through the nasal bones, zygomaticofrontal sutures (ZF), maxilla & orbital floors.

Core Operations

There are five main sub divisions in OMFS

1. Dentoalveolar
2. Trauma
3. Deformity
4. Oncology
5. Salivary Gland

Dentoalveolar

Dentoalveolar surgery is taught and practised at dental school and often involves removal of teeth which are decayed, actively infected or impacted.

Investigations

- Intraoral radiographs
- Dental panoramic pantomogram (DPT)
- Cone beam computed tomography (CBCT)
  - CT has allowed for improved 3D visualisation of teeth and associated structures

Dental Extractions

- Indicated when a tooth is deemed unsalvageable/decayed
- If these teeth are left, they can become susceptible to infection.
- If the infection persists, it can potentially compromise the airway depending on the tissue spaces the infection is draining into (see Table 16.1 below). This usually depends on the teeth.
- In a fluctuant infection, incision and drainage (I+D) may be required to drain the pus.
- However, patients with associated sepsis and trismus (limited mouth opening) will often require a GA for the extraction, I+D of the infected tissue space and several doses of IV antibiotics.
- The attachment of the mylohyoid muscle is important, as it can dictate the course of the infection.
- Submandibular infection normally originates from posterior teeth, as the roots of the teeth lie below the mylohyoid muscle.

Signs/Symptoms

- Pain originating from region of the tooth in question
- Sepsis
- Trismus
- Difficulty swallowing
- Drooling

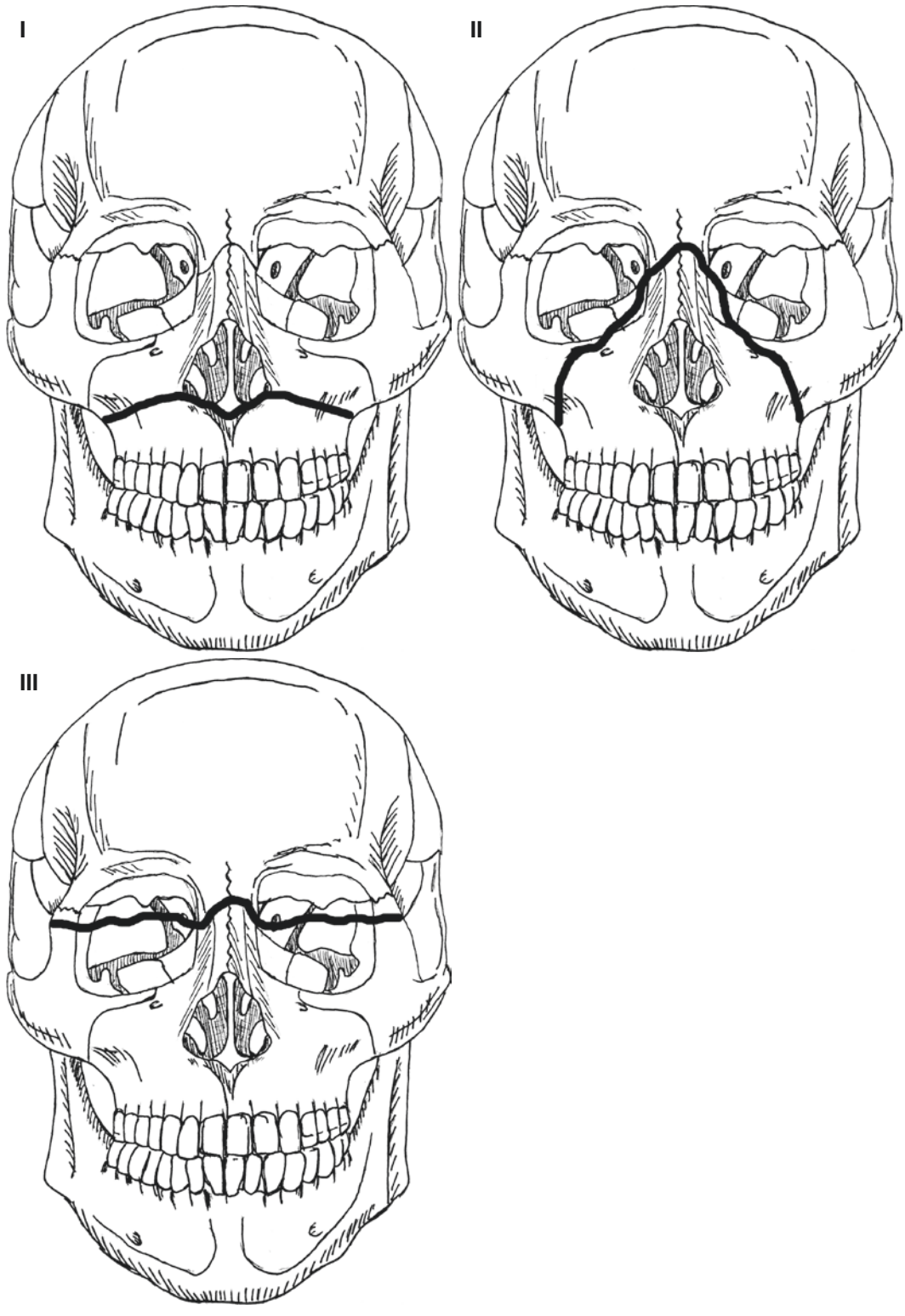

Fig. 16.2 Le Fort divisions I, II, and III

Table 16.1 Sites of swelling and the location of teeth that might be the underlying cause

Swelling	Tooth in question
Submandibular	Lower posterior
Submental	Lower anterior
Periorbital	Upper anterior
Intraoral	Adjacent tooth

- Sublingual firmness
- Altered voice
- Facial swelling

Step-by-Step Summary: Dental Extractions

1. Inject local anaesthesia
   a. Infiltration of gums around tooth
   b. Regional block
      i. Inferior dental (ID) nerve
      ii. Infraorbital nerve
2. Raising of gum flap, and bone removal
3. Use of surgical instruments to loosen and deliver tooth
4. Incision into swelling/abscess
5. Placement of drain (usually corrugated)
6. Ensure adequate haemostasis

Complications

See Table 16.2

General complications include:

- Pain
- Swelling
- Bleeding
- Infection
- Retained roots
- Damage to adjacent teeth
- Further surgery
- Weakness of lower lip
  – An extraoral submandibular incision can result in damage to the marginal mandibular branch of the facial nerve.
- Scarring
  – This can be problematic if the incision is extraoral.

Table 16.2 Potential complications of tooth extraction

Tooth	Complication	Result
Upper molars	Oroantral communication	Communication between maxillary sinus and oral cavity
Lower premolars	Mental nerve paraesthesia	Numbness of lower lip
Lower wisdoms	ID nerve paraesthesia	Numbness of lower lip, tongue, gums

Trauma

Traumatic injury to the face can result in a variety of consequences depending on the severity of the injury.

- Dental
- Mandible
- Zygomatic complex
- Orbit

Dental Trauma

Patients can present in a variety of ways to Accident and Emergency, but in essence it is better managed in dental practice.

Investigations

- DPT – to estimate damage to the teeth
- Chest X ray – to ensure that any unaccounted teeth have not been inhaled into the lungs

Signs/Symptoms

- Pain
- Bleeding
- Missing teeth
- Deranged occlusion
- Chipped teeth
- Avulsion (complete loss of tooth)

Step-by-Step Summary: Dental Trauma

1. Ensure any avulsed teeth are stored in milk/normal saline
2. Obtain good local anaesthesia

3. Attempt to manipulate the teeth/bone back to normality and check the occlusion
4. Make sure the correct teeth are in the correct socket!
5. Splint the teeth using orthodontic wire and dental composite (dental adhesive material)
6. Ensure the patient attends their dentist for follow-up care

Mandibular Trauma

- Mandibular trauma is common, and the complexity of its management can vary
- Teeth are fundamental to the success of treatment: they are used as a guide to achieve adequate reduction of the fractured mandible
- Treatment requires general anaesthetic

The following anatomical classification is useful to be able to communicate the type of fracture:

- **Condyle**
  - Part of the mandible, anchoring the mandible to the skull within a fibromuscular sling
- **Angle**
  - Distal to the last standing molar
- **Body**
  - Tooth-bearing segment from the distal molar to the canine teeth
- **Parasymphysis**
  - Tooth-bearing segment between the lower canine teeth (Fig. 16.3)

Investigations

Ensure two views are taken

- DPT
- X-Ray Mandible

Signs/Symptoms

- Pain/trismus
- Malocclusion

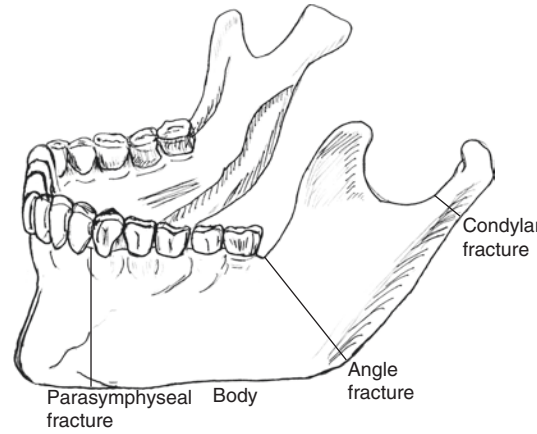

Fig. 16.3 Image of mandible and fracture areas

- Numbness of lower lip/chin
  - Paraesthesia of ID nerve or its mental nerve branch
- Gingival laceration/bleeding
- Sublingual bruising/haematoma
  - Pathognomonic of a mandible fracture

Step-by-Step Summary: Mandibular Fractures

Open Reduction Internal Fixation (ORIF)

1. Inject local anaesthesia
   a. Infiltration of the gums around tooth
   b. Regional block
      i. ID nerve
2. Expose the fracture site(s) with intraoral incisions, conscious of important adjacent structures
3. Irrigate and debride the fracture site
4. Reduce the fracture anatomically
5. Ensure normal occlusion has been achieved
6. Place titanium mini-plates and screws to fix the mandible in position
7. Close the wounds with resorbable sutures

Certain fractures may need to be accessed by an extraoral approach. These include:

- Condyle fractures
- Edentulous fractures
- Comminuted fractures

Closed Reduction

- For certain fractures, metallic bars and wires can be applied to the upper and lower teeth.
- Arch bars allow placement of wires or elastic bands to bring teeth into the correct position and restore normal occlusion.

Complications

- Infection of the miniplates
- Numbness of lower lip, chin, gingiva
  - Certain fractures in close proximity to the ID nerve and its branch (mental nerve) can be bruised and/or even damaged during the ORIF procedure.
- Damage/loss of teeth
  - If teeth in the fracture line are broken, loose or deemed of poor prognosis, they may be removed during the procedure
- Further Surgery
  - If normal occlusion has not been achieved, further surgery may be required to correct the abnormality.

Zygomatic Complex

The classic fracture pattern is known as a "tripod fracture" which results in disruption of:

- ZF suture
- Zygomatic arch
- Infraorbital rim

Classification

Clinicians will vary in their choice of classification, but a common system is the Henderson classification:

i. Undisplaced fracture
ii. Zygomatic arch only
iii. Tripod fracture & undistracted ZF suture
iv. Tripod fracture & distracted ZF suture
v. Blowout fracture of orbit
vi. Fracture of orbital rim only
vii. Comminuted fracture or other than above

Investigations

Ensure two views are taken

- X-ray facial bones
  - First line investigation for midface trauma
  - Occipitomental 10° & 30° (OM 10° & 30°)
- CT scan
  - Patients with significant head trauma usually have head and C-spine CT, which can provide more accurate 3D imaging of the facial bones

Signs/Symptoms

- Pain
- Facial deformity
- "Bony Step" deformity
- Subconjunctival haemorrhage
- Trismus
- Infraorbital nerve paraesthesia
- Epistaxis
- Eye signs (see section "orbit")
- Periorbital haematoma

Treatment

Treatment can be complex, and is normally dictated by the nature and site of the fractures. This will influence the surgical approach, which usually requires a combination of incisions. Upon adequate access to the fractures, the bones can be reduced anatomically and held in position by miniplates to restore normal form function.

Open Reduction Internal Fixation

See Table 16.3

Closed Reduction: Gillies Approach

- Allows closed reduction of zygomatic arch fractures
- Involves an incision 2 cm anterior and superior to the pinna of the ear in the temporal region
- This allows access to insert a Rowe's elevator to lift out the fractured zygomatic arch which remains stable despite no miniplate fixation.

Table 16.3 Common incisions and the regions they are used to access

Incision	Bony Access
Supraorbital	ZF suture
Transconjunctival	Infraorbital rim/orbital floor
Buccal Sulcus	Zygomatic buttress
Coronal Flap	Upper and middle facial skeleton down to zygomatic arch

Postoperative eye observations are required due to the risk of retrobulbar haemorrhage.

This is a sight-threatening condition, which results from a bleed behind the eye causing compressive ischaemia of the optic nerve. The risk of irreversible blindness, however, is small at 0.3 %.

This is a medical emergency, and will require immediate lateral cantholysis. To relieve the pressure, superior and inferior lateral canthal ligaments must be cut.

Eye Observations

- Every 15 min for the first 2 hours
- Every 30 min for the next 2 hours
- Hourly overnight

Complications

- Retrobulbar haemorrhage/blindness
- Diplopia
- Facial asymmetry
- Facial nerve injury – temporal branch
- Chronic sinusitis
- Pain, swelling, bleeding, bruising, scarring

Orbit

- Orbital trauma can result in an isolated "blow out" fracture of the orbital floor
- But it can also occur with a zygomatic complex fracture
- The orbital floor is very thin which serves to protect the globe.
- During traumatic injury, the thin orbital floor gives way as the intraorbital pressure increases, preventing the globe from being crushed within the bony eye socket.
- Trapping of the inferior rectus muscle can result in restricted eye movement, and in children, should be treated as an emergency.

Orbital trauma can result in:

- Diplopia: double vision
- Enophthalmos: displacement of the globe posteriorly
- Hypoglobus: displacement of the globe inferiorly
- Subconjunctival haemorrhage: bleeding beneath the conjunctiva

Treatment

Some of the more common approaches to access the orbital floor include:

- Transconjunctival
  - Through the conjunctival layers
- Transcutaneous
  - Through the skin of the eyelid

As with zygomatic fractures, post-operative eye observations are mandatory.

Complications

- Retrobulbar haemorrhage/blindness
- Enophthalmos
- Hypoglobus
- Diplopia
- Scarring

Deformity

Facial deformity can present in a number of ways. This can be from birth in the form of cleft lip and palate (CLP), or it can develop through a maturing facial skeleton. It can also come about following traumatic injury, or as part of a syndrome.

Orthognathic Surgery

This is an elective joint surgical-orthodontic procedure which involves creating precise bony cuts into the maxilla and mandible to create fractures at certain points to enable repositioning of the upper and lower jaws into what is deemed to be a

more aesthetically and functionally acceptable position. Orthodontic braces are worn for up to 18 months prior to the surgery to position the teeth in preparation for the new position of the jaws.

Plaster study models fabricated by maxillofacial lab technicians are utilised to provide a three-dimensional model of what the position of the teeth should be pre- and post-op. In addition, an acrylic wafer is also used to act as a guide to ensure that the teeth are in the correction position in relation to the jaws.

Complications include numbness of upper lip, lower lip, chin and tongue which may occur as a result of damage to infraorbital and inferior dental nerves.

Cleft Surgery

Cleft lip and palate deformities develop in-utero. Prevalence is 1:700 in the UK, with a number of dedicated specialist cleft centres scattered across the country.

The surgery requires a number of surgical procedures throughout childhood, including soft tissue repair of the lip, iliac crest bone grafting, orthognathic surgery and rhinoplasty.

Oncology

Oncological surgery and reconstruction is complex and beyond the scope of this chapter. However, the surgery involves removing cancerous tissue with adequate margins. Such resection can be extensive, and may require soft and hard tissue reconstruction in order to optimise adequate form, function and appearance. This normally takes place in the form of a vascularised free tissue flap.

The most common surgical procedures include:

- Hemimandibulectomy: partial resection of mandible
- Hemiglossectomy: resection of tongue
- Hemimaxillectomy: resection of maxilla

It is usually combined with a neck dissection, which involves removal of lymph nodes in the neck in order to prevent or remove metastatic spread.

Common reconstructive free flaps:

- Radial forearm
- Fibula
- Anterolateral thigh
- Iliac crest
- Scapula

Salivary Gland Surgery

There are 3-paired sets of salivary glands, all of which can present with differing pathology.

- Neoplastic disease: Benign/malignant disease
- Infectious disease: Bacterial/viral
- Obstructive disease: Salivary duct stone
- Other: developmental, inflammatory, autoimmune

Parotid

The parotid gland is situated in the preauricular region, and has branches of the facial nerve running through it. Patients occasionally have some facial weakness post-operatively, which usually improves with time. The surgical approach for parotidectomy includes making an incision in the preauricular area and removing the diseased tissue. There is potential for damage to the facial nerve and the auriculotemporal branch of the trigeminal nerve, which can result in gustatory sweating, also known as Frey's syndrome.

Submandibular

It is located under the lower border of the mandible with the lingual and marginal mandibular branch in close proximity to it. Surgery involves a submandibular incision, which carries a risk of compromise to these two nerves which may result in numbness of the tongue and weakness of the lower lip, respectively. Obstructive disease is most commonly associated with this gland.

Sublingual

This gland is located between the underside of the tongue and behind the lower front teeth.

Surgery in this area can compromise the lingual nerve, which can result in numbness to the tongue. Neoplastic disease found here is malignant in most cases.

Surgeon's Favourite Questions for Students

1. What is the vascular supply to the head and neck?
2. What are the bones of the orbit?
3. What are the branches of the facial nerve?
4. What are the nerves involved during neck dissection?
5. What are the tissue spaces involved in dental infection?

Tips for Placement

Some top tips for your OMFS rotation:

1. Ensure you get to know the registrar who will be able to teach and show you around
2. Read up on the surgical procedure and relevant anatomy the night before
3. Learn the basic anatomy of the teeth and the surrounding structures
4. Midface trauma surgery is usually delayed until the facial swelling goes down to allow assessment of the full extent of the deformity
5. Oxford Handbook of OMFS is a great resource
6. Join BAOMS – it is free as a student
7. Learn the cranial nerves in particular Facial and Trigeminal and their branches
8. Be able to perform a cranial nerve exam
9. If one mandibular fracture is suspected, look out for a second one
10. Plain film X-rays are required at different angles (normally 2) to identify fractures

Careers

OMFS is a very unique speciality in that it requires qualification in both Dentistry and Medicine, with many medical and dental schools now offering an accelerated 3-year course in either specialty as a second degree.

The Table 16.4 shows the training pathway for entry through both medicine and dentistry. Both pathways take approximately 12–15 years from the primary degree depending on fellowships, higher research degrees etc.

Table 16.4 An overview of the training pathways through medicine and dentistry to become a maxillofacial surgeon

Dental School	5 years	BDS	OMFS TRAINING PATHWAY	Medical School	5 years	MBBS
↓				↓		
Dental Foundation Training	1–2 years	MFDS/MJDF		Medical Foundation Training	2 years	
↓				↓		
Medical School	3–4 years	MBBS		Core Surgical Training	2 years	MRCS
↓				↓		
Medical Foundation Training	2 years			Dental School	3–4 years	BDS
↓				↓		
Core Surgical Training	1–2 years	MRCS		Dental Foundation Training	1–2 years	MFDS/MJDF
↓				↓		
SpR	5 years			SpR	5 years	
↓				↓		
Consultant		FRCS		Consultant		FRCS

The broad spectrum of disease allows for the development of an exceptional skill and knowledge base that is harnessed from a variety of other surgical specialities. Although the career pathway appears to be extensive, it is no longer than any of the other specialities. Surgical specialites furthermore, it provides a broad spectrum of surgery which, in combination with academic pursuits, will provide for a challenging yet rewarding career.

Useful Links

www.baoms.org.uk
www.jtgonline.org.uk