6. Injuries of the maxillofacial region

Sira S. Owibingire, Boniphace M. Kalyanyama and Elison N. M. Simon
School of Dentistry, Muhimbili University of Health and Allied Sciences
P.O. Box 65014, Dar es Salaam, Tanzania

Introduction

The oral and maxillofacial region constitutes an area of the body which is very sensitive due to its functional and aesthetic importance. It is very challenging to protect this region from injuries as it contains special organs like eyes, ears, nose and oral cavity which are often difficult to fully or individually protect while carrying out different activities. Although different protective gadgets have been developed over the years, including helmets and shields of different designs, the consistency of availability and appropriate usage of the same is a challenge.

Injuries to the maxillofacial region are discussed under three headings; soft tissue injuries, fractures of the midface and fractures of the mandible.

6.1. Soft tissue injuries

It is rare for a patient to suffer trauma of skeletal tissues without affecting the soft tissues. It is however, common to have soft tissue injuries without afflicting the skeletal tissues. Usually the soft tissue injuries are observed...
in most of the minor injuries and almost always are present in severe injuries. Conversely, hard tissue injuries are commonly seen in severe injuries where the impact of trauma is significant enough to cause bone fracture.

Soft tissue injuries include injuries to the skin, mucous membrane, subcutaneous tissues, fat, fascia, muscles, blood vessels, nervous tissues, ligaments, tendons and cartilages. Such injuries when not adequately attended to, may result into significant and permanent disfigurement and even functional interference.

The knowledge and skills of thorough assessment, diagnosis, planning and appropriate treatment of soft tissue injuries is very important. In this section we present a review of soft tissue injuries of the oral and maxillofacial region.

In Tanzania and other neighbouring countries motor traffic accidents have been found to be the leading cause of maxillofacial trauma (Adebayo et al. 2004, Deogratius et al. 2004, Waisu et al. 2005, Akama et al. 2007, Schaftenaar et al. 2009, Kamulegya et al. 2010).

6.1.1. The skin and appendages in the maxillofacial region

The skin of the maxillofacial region, as it is for the rest of the body, includes epidermal appendages which are sebaceous glands, sweat glands, apocrine glands and hair follicles. Of all the areas of the body, the face and scalp have the largest and most concentrated sebaceous glands, the reason for them being the common sites of origin of acne. The sebaceous glands produce and secrete sebum which lubricates the skin to protect it against friction and makes it more impervious to moisture. Sweat glands are found over the entire surface of the maxillofacial region except the vermillion border of the lips and the external ear canal. The function of the sweat glands is to produce sweat, which cools the body by evaporation. In the maxillofacial region apocrine glands are found as modified glands in the external ear canal (ceruminous glands) and the eyelid (Moll's glands).

Unlike in most of other areas where a delay beyond 12 hours constitutes significant risk of wound infection, due to the rich vascularity a moderate delay in treatment of soft tissues of the oro-facial region can be accommodated. The skin of the face and head in general has minor variation from one site to another. The skin covering the cheek will be slightly different from that covering the lips, nose, ear, temporal area, submandibular, frontal region and the skin around the eye or that of the scalp. This has clinical implications on wound assessment, closure and care.
6.1.2. Epidemiology

6.1.2.1. Occurrence and aetiology


The aetiology of facial injuries varies from one country to another and within the same country, depending on the prevailing socioeconomic, cultural and environmental factors (Magennis et al. 1998, Olasoji et al. 2002). Regional differences in the aetiology exist; different regions have different types of dominating aetiology of oral and maxillofacial injuries.

6.1.2.2. Common age groups and site affected

Most affected age group is 21-30 years with males more than females (Tanaka et al. 1993, Cavalcanti and Melo 2008, Kamulegeya et al. 2009, Gassner et al. 2004, Munante-Cardenas et al. 2011, Chalya et al. 2011.). However, Bamjee et al. (1996) found the 4 years old children the commonest affected. In children the commonest reported site of soft tissue injury was the tongue followed by lips (Bankole et al. 2004), while in adults there is great variation.

6.1.2.3. Causes of soft tissue injuries

In several studies the most common cause was road accidents with bicycle accidents (29.06%) and falls (28.40%) being the major causes of facial injuries in children below 13 years of age (Olasoji et al. 2002, Munante-Cardenas et al. 2011, Chan et al. 2011). Animal and human bites are also potential causes of soft tissue injuries.

Burns is another cause of tissue injury and can be due to thermal, chemical or electrical causes. Children and individuals with epileptic seizures are among the risk groups. Radiation is a special type of cause of injury and is mainly seen in patients with advanced malignant neoplasms who undergo radiotherapy.

6.1.2.4. Clinical features

Clinical features depend on the type of soft tissue injury. For instance, the features of a contusion will differ very much from those of a wound with mixed avulsion and deep lacerations.
**Abrasions:** In abrasion the epidermis, and not the dermis, is affected. There is no or minimal bleeding. However, due to disruption of terminal nerve endings there is pain. When there is bleeding the surface is usually velvet red in colour and, unless this injury was accompanied by contusion, there is no oedema. During the course of healing the wound turns to white-creamy surface before epithelialisation starts.

**Contusion:** Blunt trauma on soft tissues normally leads to contusion, which is a closed tissue injury. It may or may not be associated with haematoma formation. Sometimes oedema post trauma is significant and re-organization of the haematoma may take time, otherwise a small haematoma resolves without any intervention. There may be hypo or hyper-pigmentation with time following contusion. Although such discolouration is rarely permanent, it has a significant effect in the maxillofacial region due to its implications on aesthetics.

**Lacerations:** These include narrow puncture wounds, wide shallow cut wounds and deep cut wounds. They are caused by a penetrating object. Stab wounds are narrow and look small on the surface but may have a significant depth. Due to the shape of such wounds there is a significant challenge in the management. Thorough exploration is necessary and often an incision may be required to extend the opening for meticulous exploration, especially in instances where the status of the penetrating agent is not known. Laceration of the face follow certain weak regions/areas coinciding with skin creases, hence to some extent their pattern can be predicted.

**Avulsive injury:** This is a type of injury where some parts of soft tissues may have been lost. The causes vary including blast explosions, human and animal bites. Avulsion is the commonest type of injury associated with the bites followed by deep ragged lacerations. Loss of part of lower lip, upper lip and sometimes tongue has been the kind of common soft tissue avulsion occurring from human bites. Gun shots and other high velocity explosives resulting in loss of jaw bones and impingement of shrapnel in body tissues can be additionally observed. The avulsion can be complete avulsion with loss of tissues or sometimes can be only flap avulsion (Fig. 6.1).

**Burn injury:** Burn injury is damage to the skin caused by heat, chemicals or electricity and leads to the destruction of the protective layer of the skin. The face is at a greater risk of burn injury due to its location.
Injuries of the maxillofacial region

Figure 6.1. Deep soft tissue laceration in combination with fracture of facial skeleton and flap avulsions in a middle aged man following motor traffic accident. (Photograph by courtesy of Dr. S. Owibingire).

6.1.3. The classification system for soft tissue injuries and aesthetic units of the face

The popular system used to classify soft tissue injuries of the face is called MCFONTZL. This acronym means Modified Classification of soft tissue injuries that recognizes the following units of the face: forehead (F), orbit (O), nose (N), temporal (T), zygomatic area (Z) and lips (L). Suggested further modification has been the addition of other areas like the ears (E). From the clinical point of view this type of classification has been found to sound more applicable compared to MCFONTZL, especially when considered together with Millard’s concept of reconstruction of soft tissues (Banco and Cohen 2006) (Table 6.1).

6.1.4. Investigation for severe soft tissue injury

The extent and type of soft tissue injury may predict the presence of underlying skeletal injury and hence the need of ordering imaging. A retained foreign body in the soft and hard tissues of oral and maxillofacial site can be problematic. In most cases, conventional x-rays including orthopantomogram (OPG), Water’s view, skull postero-anterior and lateral
views are done. Soft tissue x-rays are useful when there is suspicion of lodged foreign bodies. Depending on the site involved, foreign body localization may need 3-D CT scan, mainly when surgical removal is contemplated. Site-specific ultrasound can also be useful in investigating trauma patient, especially in preliminary localization of foreign body, occult haematoma, and assessing penetrating injury. MRI is very useful in soft tissue injuries particularly in complicated orbital trauma with orbital content damage.


<table>
<thead>
<tr>
<th>Name of Unit</th>
<th>Sub-unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Forehead</td>
<td>1a: Central</td>
</tr>
<tr>
<td></td>
<td>1b: Lateral</td>
</tr>
<tr>
<td></td>
<td>1c: Eyebrow</td>
</tr>
<tr>
<td>2. Nasal*</td>
<td></td>
</tr>
<tr>
<td>3. Eyelid</td>
<td>3a: Lower lid</td>
</tr>
<tr>
<td></td>
<td>3b: Upper lid</td>
</tr>
<tr>
<td></td>
<td>3c: Lateral canthal</td>
</tr>
<tr>
<td></td>
<td>3d: Medial canthal</td>
</tr>
<tr>
<td>4. Cheek</td>
<td>4a: Medial</td>
</tr>
<tr>
<td></td>
<td>4b: Zygomatic</td>
</tr>
<tr>
<td></td>
<td>4c: Lateral</td>
</tr>
<tr>
<td></td>
<td>4d: Buccal</td>
</tr>
<tr>
<td>5. Upper lip</td>
<td>5a: Philtrum</td>
</tr>
<tr>
<td></td>
<td>5b: Lateral</td>
</tr>
<tr>
<td></td>
<td>5c: Mucosal</td>
</tr>
<tr>
<td>6. Lower lip</td>
<td>6a: Central</td>
</tr>
<tr>
<td></td>
<td>6b: Mucosal</td>
</tr>
<tr>
<td>7. Mental</td>
<td></td>
</tr>
<tr>
<td>8. Auricular</td>
<td></td>
</tr>
<tr>
<td>9. Neck</td>
<td></td>
</tr>
</tbody>
</table>

* Subdivisions of the nose: nasal tip, dorsum, columella, soft-tissue triangles, sidewalls and nasal alar region.
6.1.5. Management of soft tissue injuries

Since the injury of the soft tissues cause significant challenges in function and aesthetics, the management has to be prompt and thorough for reliably good outcome to avoid the possibility of psychological disturbance to patients (Hull et al. 2003). Although quite often in cases of maxillofacial soft tissue injuries the main concern is about aesthetics, it is emphasized that during management consideration should be given to re-establishing acceptable function. It is also necessary to protect the affected area and organs during management so as to avoid further injury. The protection required will depend on the size, extent and location of injured area.

6.1.5.1. Immediate care

The risk of succumbing to injury can be greatly reduced by the effective immediate care. Generally 25-33% of deaths caused by injuries can be prevented when an organized and systematic approach is used (Miloro et al. 2004). The pre-hospital care is very important, and a quick but thorough primary assessment and prioritization of patients according to the extent of trauma saves life. The ABCDE acronym (Box 6.1) is used for the protocol to follow in the primary survey (Miloro et al. 2004).

Box 6.1: ABCDE for Primary Survey
- Airway maintenance with cervical spine protection
- Breathing and ventilation
- Circulation and haemorrhage
- Disability and neurological status
- Exposure and environment control

6.1.5.2. Definitive management

After the initial management of the injured site to arrest bleeding and thorough assessment the injured site, definitive management of the wound is planned. This depends on the type of wound.

Management of soft tissue injuries is generally summarized by four steps; cleansing, debridement, haemostasis and closure. The type of soft tissue injury predicts the extent of treatment required. Abrasions are managed by thorough cleansing with non-irritating skin preparation antiseptic solutions, followed by application of topical antibiotic agents, preferably ointments. Copious irrigation with normal saline during cleansing is advisable in case the wound is contaminated. Only deep abrasions should
be dressed. Systemic antibiotics usually have minimal or no indication. Healing occurs very fast, with epithelialisation without scarring at the end of first week (Ellis 2004).

For contusion injuries, clean and observe the wound. Most haematomas resolve spontaneously and very few may require surgical evacuation. The traditional practice of compressing the area using warm wet cloth is not recommended. Compression using ice on a gauze, cotton or cloth is ideal as it decreases the inflammatory processes and help in decreasing swelling. Small to moderate sized haematomas on the oral and maxillofacial region can best be left to resolve without intervention. When surgical evacuation is decided the best practice is to approach the site with minimal opening evacuating the clot and irrigating with normal saline. The practice of repetitive introduction of needle for aspiration is discouraged because it could be a source of infection and may leave unsightly marks/scars, especially in hypersensitive skins and keloid formers.

The management of lacerations require thorough examination of the extent of injury, involved structures and whether in the wound there are foreign bodies which need to be removed. Depending on the extent of the injury, local or general anaesthesia is used before debridement of non-viable and severely damaged or crushed tissues. Irrigation with copious amounts of normal saline to remove any loose debris and foreign bodies is done. Hydrogen peroxide in weak concentration of 3% is used in wounds which are infected or with undetermined risk of infection. The secret of a successful soft tissue repair is precise soft tissue repositioning and closing, treatment without delay where possible, and the use of appropriate materials with well selected technique.

In most of avulsive injuries primary closure is complicated and often not feasible. The need of careful consideration for secondary healing, local flap or tissue transfer has to be made. Avulsive wounds of the face which are not properly and adequately managed are a common source of unsatisfactory cosmetic outcome.

When there is no possibility of closing the wound without tension or there has been significant avulsion of tissues, then ways of reconstructing the tissues should be thought for, planned well and instituted appropriately with consideration of aesthetics. If the wound cannot be sutured by primary intention, the use of a local flap from immediate neighbouring tissues should be considered. For instance, an avulsive injury of the lip which is just 20% can be reconstructed using neighbouring tissues of the lip and check. The use of skin graft can be used especially when there are enough of the underlying tissues devoid of skin. When such strategies are not possible then distant flap
should be considered. When all these are not feasible covering the wound with artificial prosthesis should be planned. The stepwise consideration of feasible reconstructive technique to use ranging from letting the wound heal by secondary intention to use of prosthesis follows what is known as reconstructive ladder as summarized below (Fig. 6.2).

<table>
<thead>
<tr>
<th><strong>Prosthesis</strong></th>
<th>Use of artificial materials to cover a gap which cannot be reconstructed using patient’s own tissues.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distant flap</strong></td>
<td>Used when local tissues are not adequate to cover the gap. Pedicle flap is a distant flap crossing from one region to another while retaining a stalk which is later excised when the flap has taken-up. Free tissue flap is a distant flap which depends on the local blood supply mainly by anastomosis of vessels from the donated and local tissues.</td>
</tr>
<tr>
<td><strong>Local flap</strong></td>
<td>When there are local tissues which can be made into a flap to cover the gap. Sometimes local tissues are injected with tissue expanders to eventually enable creation of enough local flap.</td>
</tr>
<tr>
<td><strong>Skin grafting</strong></td>
<td>When primary closure is not possible and the area can be feasibly covered by full or split thickness skin graft alone.</td>
</tr>
<tr>
<td><strong>Delayed primary closure</strong></td>
<td>The wound is closed after slight delay (within 48 hours).</td>
</tr>
<tr>
<td><strong>Primary closure</strong></td>
<td>The wound is closed immediately (within few hours).</td>
</tr>
<tr>
<td><strong>Healing by secondary intention</strong></td>
<td>The wound is left open then secondary closure is done when the wound has healed and re-epithelialised.</td>
</tr>
</tbody>
</table>

**Figure 6.2. Reconstruction Ladder:** From bottom-up: simple to complex soft tissue reconstruction technique.


Management of facial soft tissue injuries co-existing with fractures need careful planning on whether they can be treated promptly or there is a need for delay or a two-stage operation. With exception of special complex cases (Fig. 6.3a & 6.3b), the best practice is to consider a single immediate operation unless there are compelling reasons for delay. In any planning one should make sure that there is no gross infection, no comminuted fractures or extensive soft tissue avulsion. In addition, the patient should be in good general health, without concomitant injuries requiring more urgent attention or requiring major grafts (Motamedi et al. 2003).
Figure 6.3a. Patient who sustained explosive injury of oro-facial region with avulsion of part of the mandible, maxilla and soft tissues in the anterior region. Figure 6.3b. The end result of the possible immediate repair of soft tissues (Photographs by courtesy of Dr. B. Kalyanyama).

6.1.5.3. Dressing

Dressing of a sutured wound is essential. The objectives of dressing include debridement of necrotic tissues, packing dead space, draining or absorbing excess fluid, maintaining moist wound surface, insulating the wound and protecting the wound from further trauma (Bryant 1997). The antiseptic dressing agents recommended are several but agents containing silver nitrates (e.g. silverex, silvercel or optifoam) and iodine like povidone iodine have commonly been used in most of the settings and have proved to be effective. Others include antiseptic agents containing chlorhexidine, alcohol and acetic acid.

Dressing of the wound should be tailored depending on the status and the type. With this accord, the wounds are divided into necrotic, granular or requiring re-epithelialization. Necrotic wound needs dressing care for the purpose of absorbing the exudates and promote debridement hence hypertonic dressings (hypertonic gel, saline gauze or by use of enzymatic and debriding ointment). On the other end the granular wound which should have clearance of infection established need dressing for the sake of provision of moist environment and hence hydrogel gauze or calcium alginate are used. A wound at the re-epithelialization stage needs dressing for maintaining moisture, promoting resurfacing and/or protecting new epithelium. For such a wound the best dressing will be hydrogel sheet, hydrocolloid and foam (Krasner 1997, Harm 1999).
6.1.6. Challenges related to management of oral and maxillofacial soft tissue injuries

The management of soft tissue injuries poses a challenge especially in low economy countries. The primary challenge lies on the fact that most of patients with soft tissue injuries either delay or never report for treatment unless they have serious injuries. Delay in presenting for care has been observed among patients who come with longstanding contractures especially on the face, cheek and neck to the extent of affecting normal functions. People with contractures due to burns and some with ugly hypertrophic scars and keloids are often seen in rural communities of low economy countries.

Lack of expertise and deficiency of appropriate resources are common reasons for inadequate treatment. Other reasons include ignorance of patients and socioeconomic factors. Generally these lead to patients with soft tissue wounds being delayed and even inadequately attended.

6.1.7. Overview of prevention of soft tissue injuries

Essentially the prevention of soft tissue injuries of the oral and maxillofacial region follows the same strategies of prevention of trauma in general. They are influenced by the type of aetiology, the targeted individuals and the specific environment. Strategies focusing on the aetiology of the injuries are important in order to reduce their occurrences. Furthermore, it is suggested that clear knowledge of the injury characteristics and treatment outcome is vital in order to achieve acceptable function and cosmetic outcomes (Wang and Jiang 2003). Age specific interventions are required, since there are differences in the aetiology of injuries in children, adults and elderly. Fall is the most common cause of injuries in elderly followed by assault (Al-Qamachi et al. 2011). The majority of injuries in the elderly have been found to occur at home. As such prevention should be aimed at improving the home environment to prevent falls. The leading cause of trauma in children is fall followed by sports injuries. Prevention of sports injuries need emphasis on the use of protective gears and enforcement of sports regulations. Majority of oral and maxillofacial injuries in young and middle aged individuals are due to motor traffic accidents.

The lack of enforcement of legislation on the use of seat belts, drunken driving and inadequate emergency medical care have continued to cause considerable morbidity and mortality from these injuries in many African countries (Akama 2007, Kamulegeya et al. 2009, Schafteaar et al. 2010, Abdurrazaq et al. 2013). There is therefore a need of stringent follow-up of
abidance to traffic rules. Awareness campaigns by government agents and non-governmental organizations should be conducted to all road-users.

6.2. Fractures of the mandible

6.2.1. Introduction

More often than not patients with fractures of the mandible present for treatment mainly because of the marked resultant discomfort and disfigurement which they experience. Injuries that are commonly associated with mandibular fractures include head injury, head and neck soft tissue injuries, midface fractures, ocular injuries and even cervical injuries. The mandible is the second most frequently fractured bone of the face and the tenth most frequently fractured bone in the whole body (Ellis et al. 1985, Dongas and Hall 2002, Eggensperger et al. 2006, Akama et al. 2007, Godke et al. 2013).

6.2.2. Anatomy of the mandible

The mandible is a horse shoe-shaped bone with the following parts; the middle curved portion termed the symphysis and bilaterally there is the horizontal portion called the body of the mandible. Both the symphysis and the body of the mandible carry the tooth-bearing part, the alveolar process. Posterior to the body is the angle of the mandible joining the vertical ramus. The masseter muscle attaches itself on the lateral surface and medial pterygoid muscle on the medial surface of the angle. The ramus has two processes, the coronoid process where the temporalis muscle inserts and condylar processes that offers insertion for the lateral pterygoid muscle (at the pterygoid fovea) and articulates with the mandibular glenoid fossae of the temporal bone.

6.2.3. Epidemiology of mandibular fractures

Fractures of the mandible account for 36-70% of all maxillofacial fractures. The mandible’s prominence, shape, presence of several anatomical weak points and relative lack of support to the other skeletal structures predisposes it to frequent injuries that may result in fractures. Like other fractures of the maxillofacial region, mandibular fractures occur with a higher frequency in males aged 21-30 years (Bhamjee et al. 1996, Gassner et al. 2003, Deogratius et al. 2004, Akama et al. 2007, Godke et al. 2013,). In adults the male to female ratio is 3:1 while the male predominance
is reduced to 3:2 in children. Children below 6 years constitute 1% of all cases of mandibular fractures and often have other associated injuries.

6.2.3.1. Aetiology

Major aetiologic factors differ depending on demographic, socio-economic, cultural and geographical location. Road traffic accidents are the commonest cause in many countries while in some few others violence (social altercation, domestic violence and assaults) rate number one followed by motor vehicle accidents (Khan 1996, Bhamjee et al. 1996, Gassner et al. 2003, Deogratius et al. 2004, Akama et al. 2007, Godke et al. 2013). Fractures of the mandible usually result from blunt or penetrating trauma, but also may result from an underlying pathology. Blunt trauma may be caused by motor vehicle crashes, altercations (assaults), sporting related trauma, occupational injuries, falls and iatrogenic causes (e.g. during tooth extraction). Penetrating trauma may be a result of gunshot wounds, stabbings, and explosions. Pathologic fractures may occur due to presence of cysts and benign or malignant tumours. Other conditions that predispose bones to pathologic fractures include osteogenesis imperfecta, osteomyelitis, osteomalacia, bone atrophy, osteoporosis and osteoradionecrosis.

6.2.3.2. Common sites of fracture

The notable areas of weakness for the mandible include the condylar neck, angle and symphysis. Anatomical variations in the occurrence of mandibular fractures have been reported from different studies: condyle (20-35%), angle (20-30%), symphysis (8-20%), body (15-30%), ramus (1.7%), coronoid (1.3%) and alveolar ridge (1-5%) (Peterson et al. 2003, Akama et al. 2007, Gassner et al. 2003, Shah and Salam 2006, Umar et al. 2010, Godke et al. 2013). Automobile accidents commonly cause condylar and symphyseal fractures while in motorcycle accidents the symphysis and alveolus are the ones most commonly fractured. In assault the angle, body and condyles have the highest incidence of fracture.

6.2.4. Types of mandibular fractures

Simple or closed fracture – a fracture that does not produce an open wound through the mucosa or skin.

Compound or open fracture – a fracture in which there is an external wound involving skin, mucosa or periodontal membrane that communicates with the break in the bone.
Comminuted fracture – a fracture in which there are more than two fragments with communicating lines of fracture.

Greenstick fracture – a fracture that occurs with the line of fracture on the cortical plate of bone on one side but not running through to the other side. This mostly occurs in children.

Pathologic fracture – a fracture that occurs because of a weakness due to pre-existing bone disease e.g. osteomyelitis or some bone pathological changes. It usually occurs from mild impact.

Multiple fracture – is a type of fracture with two or more lines of fracture on the same bone but are not communicating with one another.

Impacted fracture – a fracture in which one of its fragments is compacted firmly into the other.

Complicated or complex fracture - This is a fracture in which considerable injury to the adjacent soft tissues or adjacent structures occur. It may be simple or compound.

6.2.5. Fractures of the different anatomical regions of the mandible

6.2.5.1. Symphyseal and parasymphyseal fracture

Symphyseal fracture occurs in the region of the incisors that runs from the alveolar process through the inferior border of the mandible. They are usually due to an antero-posterior impact like falling and hitting the chin on the ground. Fractures in this region are usually stable when the fracture lines run in the postero-anterior direction. Parasymphyseal fracture occurs in the canine–premolar region.

6.2.5.2. Fractures of the body of the mandible

Fractures commonly occur in the canine region due to the weakness created by the presence of the long root of the canine tooth or in the premolar region due to the presence of the mental foramen. When fractures occur bilaterally in the canine or premolar region, the anterior central portion of the mandible falls downwards and backwards leading to loss of tongue control and possible airway obstruction. This is due to gravitational and pulling effect of muscles inserted at the genial tubercle.

6.2.5.3. Angle and ramus fractures

Angle fractures occur around the triangular region between the anterior border and posteroinferior attachment of the masseter muscle (usually distal to the third molar).
Ramus fractures are usually located between the angle and the sigmoid notch.

6.2.5.4. Fractures of the condyle and coronoid process

Condylar fractures involve the area of the condyle while coronoid fractures include the coronoid process of the mandible. Fractures of the neck of the condyle may result from direct heavy blow to the temporomandibular joint area, causing unilateral condylar fracture or to the point of the chin producing bilateral condylar fractures. Condylar fractures may be intracapsular, extracapsular, or subcondylar. Fractures of the neck of the condyle sometimes have little displacement if the periosteum remains intact. The lateral pterygoid muscle tends to cause displacement of the condylar head whereby the fractured upper fragment may be displaced anteriorly and medially and in more severe cases the joint may be dislocated from the glenoid fossa.

Based on displacement and angulation, five types of condylar fractures are described in order of increasing severity:

*Type I* is a fracture of the neck of the condyle with relatively slight displacement of the head. The angle between the head and the axis of the ramus varies from 10-45°.

*Type II* fractures produce an angle from 45-90°, resulting in tearing of the medial portion of the joint capsule.

*Type III* fractures are those in which the fragments are not in contact, and the head is displaced medially and forward. The fragments are confined within the area of the glenoid fossa. The capsule is torn, and the head is outside the capsule.

*Type IV* fractures of the condylar head articulate on or in a forward position with regard to the articular eminence.

*Type V* fractures consist of vertical or oblique fractures through the head of the condyle.

In unilateral displaced fractures, the affected ramus shortens, leading to premature posterior contact of the dentition and the chin deviates towards the affected side. In bilateral fractures there is premature contact of the posterior teeth on either sides that lead to anterior open bite with minimal or no deviation.

6.2.5.5. Fractures of the ramus

These fractures are uncommon as this part of the mandible is shielded from direct trauma by the muscles and is usually stable because fragments tend to be impacted together by combined pull of the muscles.
6.2.5.6. Alveolar fracture

This is a type of fracture that occurs in the tooth bearing region of the mandible.

6.2.6. Muscular forces acting upon the mandible

The effect of muscle action on the fracture fragments is important in classification of mandibular fractures. The position and direction of the fracture lines in relation to muscle attachment determines whether the fragments are displaced away or are towards each other. The muscles attached to the angle and beyond (masseter, temporalis, medial pterygoid) pull the proximal segment upward and medially or laterally. The symphysis of the mandible is displaced inferiorly and posteriorly by the pull of the digastric, geniohyoid, mylohyoid and genioglossus muscles. If the fracture line runs backwards and medially the fragments tend to be impacted into each other preventing medial displacement of the posterior fragment, this is said to be vertically favourable. If the fracture line runs backwards and laterally the fracture is unstable and vertically unfavourable (Fig. 6.4).

![Image of a fractured mandible](image-url)

Figure 6.4. Fracture of mandible: vertically unfavourable with fracture line passing through tooth number 48 (Photograph by courtesy of Dr. S. Owibingire).

6.3. Fractures of the mid-face

6.3.1. Anatomy

The middle third is that part of the face that lies between a horizontal line drawn through supraorbital ridges above, and the occlusal plane of the upper teeth or in case of edentulous patients, the ridge of the alveolar crest of
the maxilla below. The bones that are found in this region are: 2 maxillae, 2 zygoma, 2 nasal bones, 2 lacrimal bones, 2 palatine bones, 2 inferior concha, 2 zygomatic process of temporal bone, 2 pterygoid plates of sphenoid bone, the vomer and ethmoid bones.

6.3.2. Epidemiology of fractures of the middle third of the face

Facial fractures are the result of various types of trauma to the face and may occur in isolation or in combination with other injuries. The incidence of maxillofacial fractures varies widely between different countries. Diagnosis and treatment of facial fractures remains a challenging problem that frequently requires a multidisciplinary approach. Mid-face fractures are a common occurrence among patients attended in urban health facilities.

The main causes worldwide are traffic accidents, assaults, falls and sports injuries.

Studies performed in countries in different parts of the world have shown that motor vehicle crashes were the most common cause of maxillofacial fractures (Telfer et al. 1991, Tanaka et al. 1993, Gassner et al. 2003, Motamedi M 2003, Shah et al. 2003, Brooks C 2004, Adeyamo et al. 2005). Although in the past maxillofacial injuries were reported to be more often caused by interpersonal violence in sub-Saharan Africa, current studies show that the causes are similar in developed countries (Telfer et al. 1991, Tanaka et al. 1993, Bhamjee 1996, Khan 1996, Motamedi M 2003, Shah et al. 2003, Gassner et al. 2003, Brooks C 2004, Adeyamo et al. 2005, Shaftenaar et al. 2009).


6.3.3. Classification of midface fractures

There are several systems for classifying midface fractures. These classifications have been proposed for midface fractures due to a myriad of fracture patterns obtained which reflect the complex nature of the midface. However, it is not so often that one comes across a classical fracture of a particular classification. Most often they occur in a mixed pattern (Fig.6.5). Nevertheless, it is necessary for one to be conversant with the different classifications since it simplifies discussions among professionals and aids in management planning.
Figure 6.5. Multiple fractures including the mandible and bones of the mid-face showing a typical example of mixed pattern. (Photograph by courtesy of Dr. E. N. Simon).

Maxillary fractures

René Le Fort’s (French surgeon, 1869–1951) experimentally-based categorization of midface fracture patterns is the most popular one. This simple classification system distinguishes three fracture patterns.

Le Fort I

It separates the whole complex of alveolar and palatal processes of the maxilla, horizontal plates of the palatal bones and lower parts of the pterygoid plates just above the pterygo-maxillary junction.

Le Fort II

Separates the whole maxilla with part of the nasal bones and the lower part of the pterygoid plates (also known as "pyramidal" fracture).
Injuries of the maxillofacial region

Le Fort III

Separates both zygomatico-maxillary complexes plus the nasal bones, palatal bones and most of the pterygoid plates from the rest of the cranium (also known as craniofacial dysjunction or transverse fracture).

In clinical practice Le Fort types of fractures are very rarely encountered in classical forms as described theoretically. In most instances the fracture lines of particular types combine in quite unpredictable, often asymmetric patterns. The reason for this variability rests with the many different trauma mechanisms and high energies involved.

Zygomatic bone fractures

Because of its anatomy and its functions in the maxillofacial region, fractures of this bone have different classifications by different authors. In this chapter Henderson's classification of malar bone fractures is used.

Henderson's classification of malar bone fractures:

1. Undisplaced fracture, any site
2. Zygomatic arch fracture only
3. Tripod fracture with undistracted frontozygomatic suture
4. Tripod fracture with distracted frontozygomatic suture
5. Isolated blow out fracture of the orbit
6. Fracture of the orbital rim only
7. Comminuted fracture or other than above

Naso-orbito-ethmoid complex (NOE) fractures

The key component of NOE complex reconstruction is the bony central fragment onto which the medial canthal tendon inserts. Each fracture type is subclassified as either unilateral or bilateral. Type I fractures represent a single noncomminuted central fragment without medial canthal tendon disruption. Type II fractures involve comminution of the central fragment but the medial canthal tendon remains firmly attached to a definable segment of bone.

Type III fractures are uncommon and result in severe central fragment comminution with disruption of the medial canthal tendon insertion.

Zygomatic arch fracture

The zygomatic arch is a thin structure that is made up by the temporal process of the zygomatic bone and the zygomatic process of the temporal bone. These two arches are bilateral and symmetrical. Minor force or hitting
against a hard structure like a wall of a house can easily result in fracture of the zygomatic arch. It also commonly occurs during collisions of players in games and sport. Fracture of the arch may result in impingement of the coronoid process of the mandible during the normal excursions.

When occurring together with the zygoma fracture it is called a zygomatic complex fracture.

**Aetiology of fractures of the mid-face**

Aetiology is best considered under the following broad headings:

Assaults, falls, road traffic accidents, industrial injuries, sports injuries, war injuries.

**Signs and symptoms of mid-face fractures**

**Maxillary fracture**

Facial swelling – massive edema (Fig. 6.6), bilateral circumorbital ecchymosis (Panda facies or Raccoon eyes), lengthening of the face, abnormal mobility of midface, pain over nose and face, malocclusion (anterior open bite), diplopia, anaesthesia-infraorbital nerve damage, blood and cerebral spinal fluid discharge from the nose.

**Zygomatic bone fractures**

Diplopia, enopthalmos, subconjunctival ecchymosis, flattening of the cheek, gagging of the occlusion and sensory disturbances.

![Figure 6.6. Facial appearance of a patient with midfacial fractures (Courtesy of Dr. S. Owibingire)](image-url)
Naso-orbito-ethmoid (NOE) fractures

Nasal deformity, bruising and swelling, nasal bone crepitus, frontal bone depression, traumatic telecanthus, CSF fluid rhinorrhea and diplopia.

6.4. Management of fractures of the maxillofacial region

6.4.1. Patient evaluation

Before taking detailed history and doing complete physical examination first assess patient’s cardiopulmonary stability by ensuring a patent airway and adequate ventilation. Check and record down vital signs that include respiratory and pulse rates, and blood pressure. Excessive bleeding should be stopped by pressure dressings, packing or clamping or ligation of briskly bleeding vessels, and then treat shock. Furthermore, assess patient’s neurologic status, assess the cervical spine and immobilize the neck until neck injuries have been ruled out by taking cervical spine x-rays.

Airway management

In severe bilateral mandibular fractures the anterior fragment usually falls backwards resulting in airway obstruction and therefore the mandible must be repositioned and the fragment fixed anteriorly. Placement of a nasopharyngeal or oropharyngeal airway device temporarily or endotracheal intubation should be done. Remove prosthesis, avulsed teeth/pieces of bone, debris, clots, suck saliva/blood and any other secretions from the pharynx. Sometimes tracheostomy may be necessary like in fractured larynx.

History

This should be taken after stabilizing the patient. A complete medical and psychiatric history is important for diagnosis and future treatment of mandibular fractures. Patients usually present with history of injury followed by pain, swelling, deformity and abnormal mobility of the mandible. Information needed includes: How and when the accident occurred, type of injury sustained, type of object contacted, the direction from which contact was made and if there was any loss of consciousness.

The source, size, and direction of traumatic force are helpful in making diagnosis. Fractures sustained by a fist tend to have single, simple, or nondisplaced fractures whereas patients involved in motor vehicle accidents sustain compound comminuted fractures. Localized trauma (e.g., pipe, stick, hammer) tends to cause a single comminuted fracture since the force is
concentrated in a small area. Trauma distributed to a larger surface area may cause several fractures (e.g., symphysis, condyle) secondary to distribution of the force throughout the mandible. Direction of the force can also help in making the diagnosis of concomitant fractures. Trauma directed to the chin often results in a symphyseal fracture with concomitant unilateral or bilateral condylar fractures. The presenting symptoms should be put down and all body systems reviewed. Information on previous tetanus immunization should be recorded.

6.4.2. Examination of the patient

General examination

Due to multiple injuries, combined efforts of different specialists may be necessary. The facial, cranial and neck regions should be examined for evidence of trauma, like lacerations, abrasions, contusions, oedema or haematoma and ecchymosis. Lacerations under the chin could indicate subcondylar or symphysis fractures, while bruises behind the ear (or Battle’s sign) suggest a skull fracture. Bleeding into the tissues around the fracture usually occurs under the skin or mucous membrane in the sulcus or floor of the mouth. Ecchymosis in periorbital region especially with subconjunctival haemorrhage could indicate orbital rim or zygomatic complex fractures. Ecchymosis in the floor of the mouth may indicate a mandibular body or symphyseal fracture. A step deformity or abnormal contour may be noted when the inferior border of the mandible is palpated.

A neurologic examination of the face should include careful evaluation of all cranial nerves. Visual or extraocular movements, and pupillary changes may suggest intracranial (cranial nerve II, III, IV, or VI) damage or orbital trauma.

Abnormal ocular movements may indicate either central neurologic problems or mechanical obstruction of the movements of the eye muscles due to fractures around the orbital area. Note areas of paresthesia or anesthesia along the distribution of the inferior alveolar nerve. Numbness in this region is almost pathognomonic of a fracture distal to the mandibular foramen.

Standing in front of the patient, ask the patient to attempt opening the mouth while you are palpating the movement of the condyle just anterior to the external auditory meatus. Pain elicited through palpation and crepitations heard in the preauricular region should alert the clinician to a possible condylar fracture.
Injuries of the maxillofacial region

**Intraoral examination**

Observe any deviation on opening of the mouth. Classically, deviation on opening is toward the side of the mandibular condyle fracture. Note any limited opening and trismus that may be a result of reflex muscle spasm, temporomandibular fusion, or mechanical obstruction to the coronoid process resulting from depression of the fractured zygomatic bone or arch. Changes in occlusion are highly suggestive of a mandibular fracture. A change in occlusion may be due to a displaced fracture, fractured teeth and alveolus, or injury to the temporomandibular joint. However, a pre-existing malocclusion like a crossbite should not be mistaken for a fracture. Look for intraoral mucosal or gingival tears. Floor of the mouth ecchymosis may indicate a mandibular body or symphyseal fracture. If a fracture site along the mandible is suggested, mobility can be detected by holding a fragment in each hand and finding if one can be moved in relation to the other. When there is movement a grating noise (crepitations) may be heard as the bone fragments rub against each other. Abnormal mobility of the fractured bone fragments is present unless they are impacted into each other. Status of the dentition should also be examined.

**6.4.3. Investigations**

Imaging studies must be done to confirm or determine the presence of a fracture, direction of the fracture line, relationship of the teeth to the fracture line and severity of the bone damage and presence of fractures in other parts of the bone. Types of radiographs helpful in diagnosis of mandibular fractures include:-

**6.4.3.1. Panoramic radiograph**

This view is most effective for initial screening of patients because it shows the entire mandible including condyles.

**6.4.3.2. Lateral oblique view**

It is the most useful and shows the area from the premolars to the condyle and should be centered upon the probable area of the fracture. Both sides of the jaw should be taken. It can be used when obtaining a panoramic radiograph is not possible like in severely traumatized patients.
6.4.3.3. **Posterior anterior view**

Shows the whole of the mandible but the condylar heads may be hidden by the zygomatic bone and obscured by the superimposition of the mastoid process, and so does the incisor region by the superimposition of cervical vertebrae.

6.4.3.4. **Reverse Towne view** is the plain film of choice for excluding condylar and subcondylar fractures

6.4.3.5. **Transcranial temporomandibular view** can also detect condylar fractures and anterior displacement of the condylar head.

6.4.3.6. **Occlusal view**

This is helpful for accurate assessment of symphyseal fractures because it gives the direction of the fracture line in the horizontal plane. It is also useful in the incisor region which is difficult to show in other views.

6.4.3.7. **Periapical view**

Shows bony details such as the relationship of a tooth to a fracture line and helpful in assessing root fractures.

6.4.3.8. **Occipital mental view of the skull (Water’s view)**

This is a very handy view for visualising all the fractures in the middle part of the face, including blow out fractures of the orbit.

6.4.3.9. **Submental vertex view of the skull**

This is specifically for the zygomatic arches. Because these structures are thin and may be blackened-out when high power is used, therefore this view must be done with low power.

6.4.3.10. **Soft tissue lateral view**

This is a specific view for injuries involving the nasal bones.

6.4.3.11. **Computed tomography (CT scan)**

CT gives a three dimensional imaging of the skull. It is very helpful in visualizing fractures in any part of the skull including the different parts of the maxilla and mandible. It makes treatment planning easy.
6.4.4. Treatment of maxillofacial fractures

The treatment of facial bone fractures aims at achieving rapid bone healing, a return to normal ocular, masticatory, and nasal functions, resumption of normal speech and restoration of an acceptable facial and dental aesthetic result. In order to achieve these goals, basic surgical principles for the treatment of facial bone fractures should be observed. These include reduction of the fracture (restoration of the bony segments to their proper anatomical position), fixation and stabilization of the bony segments, immobilization of the fracture site and restoration of occlusion, prevention and eradication of infection. In the case of accidents leading to injuries of soft tissues and severe wound contamination, anti-tetanus toxoids and antibiotics should be given. It is advisable to extract teeth in the line of fracture to avoid infection that may originate from the gingival margins, periodontal pockets and the necrotic dead pulp of tooth in the fracture line.

The timing of treatment of facial fractures

Prior to management of maxillofacial fractures, the patient should be properly assessed. Reduction can be delayed until the patient is stable. Fracture reduction should be done within 7-10 days because after this period, the risk of infection, malunion, malocclusion, and facial asymmetry increases. Ideally, the treatment should be done as soon as possible when the condition of the patient allows. An injury such as severe neurologic trauma that precludes pre-surgical stabilization of the patient and increases anaesthetic and surgical risks should be managed before facial bone fractures.

Challenges

There are common challenges encountered in the management of maxillofacial fractures, more so in developing countries compared to developed ones. Such challenges include: delay in patient presentation, inadequate diagnostic and management equipment and materials and inadequate qualified human resource in most of the health facilities, all of which contribute to low quality definitive care. Since most of the health facilities do not have established specialities like otorhinolaryngology, neurosurgery and biomedical engineering, interdisciplinary approach which is essential for complete management of maxillofacial trauma is not possible. Lack of ideal equipment and materials for management of maxillofacial trauma cases is a frequent encounter. The ordinary reconstruction plates in
particular the recommended absorbable plates in some occasions are expensive for an average patient. The state-of-the art procedures like use of endoscopic techniques in management of condylar fractures instead of extensive open reduction cannot be practised in most places due to lack of equipment and expertise.

**Techniques of immobilization of mandibular fractures**

The most common techniques for IMF or maxillomandibular fixation (MMF) include fabricated arch bars, Ivy loops (interdental eyelet wiring), continuous loop wiring and Risdon wiring.

**Use of arch bars**

A pair of wire cutter is used to cut the bars to the appropriate length for each jaw and these should be long enough to allow bending towards the posterior surface of the last available tooth. The arch bar should be placed with the hooks facing the gingiva and moulded to align along the necks of the teeth. It is advisable to have the arch bar spanning as many teeth as possible.

A 0.5 mm stainless steel soft wire should be cut into pieces of about 10 cm long with which the arch bar is secured to the teeth. The ends of the wires should be bent inwards to prevent cheek and lip injury. The arch bars of both jaws are then fixed with rubber bands or wires to complete the IMF/MMF (Fig. 6.7).

![Immobilization of mandibular fracture by arch bars and inter-maxillary wires](image)

**Figure 6.7.** Immobilization of mandibular fracture by arch bars and inter-maxillary wires (Courtesy of Dr. Shaaban D.)
Injuries of the maxillofacial region

Ivy loops (interdental eyelet wiring)

In order to make eyelets the 0.5 mm stainless steel soft wire should be cut into pieces of 15 cm lengths. A minimum of five eyelets must be fixed in either jaw in suitable places, so that when they are joined by intermaxillary wires they will run diagonally in both directions and brace the jaws together (Fig. 6.8).

![Image of Ivy loops on a fractured mandible](image1.png)

**Figure 6.8.** Eyelet wiring (ivy loops) of a fractured mandible (Courtesy of Dr. Shaaban D).

Continuous loop wiring

Continuous multiple loop interdental wiring is a simple, effective method and secures the maximal anchorage for traction and retention.

Risdon wiring

This is used as an alternative to an arch bar for a fracture of the mandible that needs fixation. Each of the two wires of equal length (about 25 cm) is twisted around the most posterior tooth then twisted and laid on buccal aspects of teeth toward the midline. Two twisted wires from either side are twisted around each other at the midline. Each tooth on the arch is then ligated to the wire with the formation of the small hook which then assists in intermaxillary immobilization by either rubber or wire.

Treatment of mandibular fracture of an edentulous patient

In unstable or displaced fractures dentures can be wired to the mandible with circummandibular wiring, and the maxillary denture can be secured to
the maxilla using either wiring technique or bone screws to hold the denture in place (gunning-type splints). The maxillary and mandibular dentures are then wired together similar to IMF. When there is no gross displacement of the fragments, a thick pad of cotton wool may be applied and a supporting bandage placed round the jaw.

**Splinting**

Occlusal or lingual splinting technique is useful in children in whom placement of arch bar is difficult because of deciduous dentition and lack of cooperation. Splints are usually applied in situations where there is minimal displacement of fracture fragments. Furthermore, fractures in children are known to relatively heal quickly, so the splints can be kept for shorter periods lest they play role in hampering jaw growth.

**Open reduction and internal fixation (ORIF)**

This is another method that is used in treating fractures by using interosseous wiring or plates and screws. In order to achieve reduction and fixation of the fracture surgical access is necessary.

**Indications for open reduction**

Indications for open reduction include the following:

Displaced unfavourable fractures, complex facial fractures, severely atrophic edentulous mandibles that have little cancellous bone and minimal osteogenic potential, gross displacement of the condyle, presence of concomitant medical conditions that interfere with metabolism and/or bone formation, nonunion and malunion.

**Contraindications of open reduction**

There are no absolute contraindications for open reduction, however, bone diseases or conditions such as osteoradionecrosis, osteitis, osteomalacia, osteoporosis, osteogenesis imperfecta may rule out the possibility of such treatment. Some of the relative contraindications include poor bone height and mixed dentition that limits the placement of fixation devices.

**Open reduction with wire osteosynthesis**

This is advisable when initial assessment shows that closed reduction cannot adequately immobilize the fracture or when attempts with closed
Injuries of the maxillofacial region

reduction alone have failed. These are best immobilized by wiring the fragments together across the fracture line.

Traditionally stabilization of bone after open reduction is achieved by placing direct intraosseous wiring combined with IMF for 4-8 weeks.

**Open reduction with rigid fixation (bone plates and bone screws)**

Techniques for rigid internal fixation using bone plates, bone screws or both to fix the fracture have gained popularity globally. These methods result in more rigid and stable fixation of the bone fragments, and do preclude the need for the torturing prolonged MMF. Nevertheless, the centric/functional occlusion should be established before reduction, stabilization and fixation. Additional advantages of this method include improved postoperative nutrition and hygiene, better postoperative management of patients with multiple injuries and decreased discomfort and inconvenience to the patient.

**6.4.5. Complications of mandibular fractures**

**Infection**

Without the use of antibiotics, a significant number of patients may get infection that can be due to local or systemic factors, or both. Common local factors are poor reduction and immobilization, fractured teeth in the line of fracture, avulsion and compound fractures while systemic factors include immunosuppression and malnutrition. Teeth in line of fracture should be extracted before infection sets in unless retention of the tooth is important for control of the fragments, in which case, the patient should be covered with antibiotics for a prolonged period of time and monitored frequently.

**Delayed union and non union**

Delayed union is a temporary condition which commonly occurs due to poor reduction and immobilization, presence of foreign body or interposition of tissue between fragments and nutritional deficiencies. When factors leading to the condition are controlled, bony union eventually takes place spontaneously.

Non-union is complete failure of the fracture to heal, characterized by prolonged abnormal mobility at the fracture site, often forming a pseudo joint. The condition may be caused by infection, poor reduction and immobilization, interposition of soft tissues or foreign bodies, impaired local blood supply and metabolic and vitamin deficiency or a combination of these
factors. Management of delayed union/non union should basically aim at removing all the suspected causative factors.

**Malunion**

Malunion is the improper alignment of the healed bone segments. Not all malunions are clinically significant. Natural remodelling of the bone may progressively obliterate the defect and restore a fairly normal contour. However, in case of severe malunion re-fracturing and realignment of the bone fragments should be done, followed by fixation/immobilization.

**TMJ ankylosis**

This complication is common in children and is often associated with intracapsular fractures and prolonged immobilization of the mandible. This occurs secondary to intra-articular haemorrhage with eventual fibrosis and ankylosis. It may also arise due to infection within the joint or descending from the middle ear. In most cases this results in disturbed growth of the mandible, facial asymmetry and deviation of the jaw towards the affected side.

**Nerve injury**

The inferior alveolar nerve and its branches are the most commonly injured nerves leading to paraesthesia of lower lip and chin. On rare occasions branches of the facial nerve are also involved.

### 6.4.6. Treatment of mid-face fractures

Treatment mainly depends on the type of fracture. The basic general principle of reduction and immobilisation aimed at restoring function (mastication and speech) and aesthetics holds. The mid-face fractures are usually stabilized by suspension of fractured fragment to the next stable bone above or through fixation using mini-plates. In both situations open reduction may be necessary. Maxillomandibular fixation is applied to maintain occlusion. In the situations where mid-face and mandibular fractures occur together treatment is done simultaneously, unless there are other compelling factors. Where patients cannot afford the cost of mini-plates interosseous stainless steel wires can be used.

### 6.4.7. Challenges in the management of midfacial fractures

The severe oedema which most often patients with midface fractures present with may necessitate delay in the definitive management of the
patient. In quite a good proportion of patients with midface fractures, the airway is simultaneously involved. This complicates the management. Concurrent injuries to the cervical spine and possibly accompanying head injuries are other complicating factors in the management of mid-face fractures. Le fort III fractures may be accompanied by fractures of the base of the skull. Delay in the proper management may lead to infection resulting in meningitis.

From the fact that the midface have many interrelated anatomical structures, injuries in this region often demand very close cooperation of different specialties. For example it is common to see the maxillofacial surgeon seeking the involvement of the ophthalmologist in management of patients with zygoma fractures where the orbital structures are involved. Similarly, the otorhinolaryngologist is needed in cases where the nasal bones are involved. The most unfortunate thing for developing countries is the fact that such specialties are not available at most health facilities.

References


