EPIDEMIOLOGY AND EVALUATION OF RESULTS OF EARLY MANAGEMENT OF MIDFACIAL FRACTURES IN A TERTIARY CARE HOSPITAL

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THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI, TAMILNADU
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CERTIFICATE

This is to certify that this dissertation titled “Epidemiology and Evaluation of Results of Early Management of Midfacial Fractures in a Tertiary Care Hospital” has been prepared by Dr.K.K.Senthilkumaran under my supervision in the department of Plastic Surgery, Chengalpattu Medical College and Hospital Chengalpattu during the academic period 2010-2013 and is being submitted to the Tamil Nadu Dr. M.G.R. Medical University, Chennai in the partial fulfillment of the university regulation for the award of the Degree of Master of Chirurgie (M.Ch Plastic Surgery - Branch-III ) and his dissertation is a bonafide work.

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I, Dr. K.K. Senthilkumaran, solemnly declare that the dissertation “Epidemiology and Evaluation of Results of Early Management of Midfacial fractures in a Tertiary Care Hospital” is a bonafide work done by me in the department of Plastic and Reconstructive Surgery, Chengalpattu Medical College and Hospital, Chengalpattu, after getting approval from the ethical committee, under the guidance of Prof. Dr. V. Usha Ganesan, M.S., M.Ch., Professor and HOD, Department of Plastic Surgery, Chengalpattu Medical College, Chengalpattu.

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Introduction
INTRODUCTION

Management of midfacial trauma occupies a major part in the speciality of plastic surgery. These injuries are commonly seen in our day to day practice. These are associated with multisystem trauma which ultimately require combined management with other specialities like Emergency Physician, Ophthalmologist, Otolaryngologist, Trauma Surgeon and Neurosurgeon.

These injuries affect various functions such as vision, hearing, breathing, smell and speech because of association of all these sensory organs in the face. Most important is the psychological impact of disfigurement of face after faciomaxillary injuries.

Most of the injuries are the result of low energy impact and these can be managed with available specialized treatment techniques in plastic surgery. Whereas major injuries due to complex high energy impact are a real burden to the plastic surgeon and management involves multidisciplinary team of surgeons. It is really a challenge for faciomaxillary trauma surgeon to maintain low complication rates for severe facial injuries and also avoid undue morbidity.

Motor vehicle accidents in patients who did not wear helmets have produced major facial injuries. The bones most commonly involved were Zygoma, Nasalcomplex and Mandible. In urban areas the most common
cause of facial injuries are due to motor vehicle accidents followed by assault, fall, industrial accidents and sports injuries.

There are 3 parts in the facio-maxillary region.

- Upper face involves fractures of frontal bone, and sinuses.
- Midface is defined as the area bounded above by a transverse line joining the zygomatico-frontal suture bilaterally which also passes in the middle through the fronto-maxillary and fronto-nasal suture and bounded below by incisal and occlusal plane of maxillary teeth.
- Mid face is further divided in to upper and lower part. Upper face fractures includes maxilla with Le Fort II,III fractures, fractures of nasal bone, nasoethmoidal, zygomaticomaxillary complex and orbital floor. Lower part of midface fractures include Le Fort I with fractures of alveolar bone and teeth.

The lower part of face is associated with isolated Mandible fracture.

So far various analytical studies have been done at various centers all over the world to assess the cause, type, incidence, demographic distribution and results of various types of managements of facio-maxillary fractures. Various parameters like age, gender, type of injury, time of accident, site of injury, various modalities of treatment, duration between accident and surgery, results of early and late management of fractures and their complications have been analysed in this study.
Aim of Study
AIM OF STUDY

This study was done to collect and analyse current data on aetiology, biomechanics and demography of patients admitted with midfacial fractures at Chengalpattu Medical College and to assess the association of midfacial fracture with gender, occupation, social behaviour and mechanism of injury.

It is also to evaluate the result of early management and its effect on functional and aesthetic outcome of midfacial fractures.
Review of Literature
REVIEW OF LITERATURE

Facial trauma is often associated with severe morbidity with respect to loss of function and disfigurement as well as the impact of increased financial cost to both the state and affected individual. Of the 1500 facial fractures analysed by Rowe and Kelly [7] 629 (41.9%) involved fractures of the mid third. Kelly and Harrigan [7] analysed 4317 facial fractures of which 594 (13.76%) involved the mid facial skeleton.

An analysis of the association between the epidemiology and associated injuries is very important in order to improve treatment and prevention. Beaumont et al [8] had undertaken study of 389 patients with facial fractures in three population groups. In that study it was found that male to female ratio was 4:1. In all ethnic groups, the peak incidence of fracture was in the third and fourth decades. The mean age group for Blacks, Asians and Whites were 32, 30 and 27 years respectively. Interpersonal violence was the main cause in black population. In the white population, motor vehicle accidents were the main reason. In all groups the mandible was most commonly fractured site followed by the mid face.

Snijman [9] and Duvenage [10] in 1963 and 1979 respectively studied midfacial fractures in the Tshwane district of the Gauteng province and found similar result as above. Snijman noted assault as the main cause of fracture in the black population and motor vehicle accidents in the
whites. They also found that third decade peak was noted with a similar male predominance.

Balakrishnan [12] studied 313 cases in Trivandrum in 1980 and found male population (93.3%) was involved the most and it was due to motor vehicle accidents. They did not give any reason as to why there were only male patients involved. Was it due to less women occupants and drivers in motor vehicle accidents or women were better drivers? In this study also, patients were in the third decade. The common cause was road traffic accidents followed by assault. After two decades, a study done in other districts in India showed a decrease in male female accident ratio as 3.7:1 [13]. In Netherlands Van Beek [14] found increasing injuries due to violence and sports. Surprisingly there was decreased incidence of road traffic accidents.

Green [16] noted, among mid facial fractures Zygomatico Maxillary (ZMC) fracture was the highest, followed by orbital blow out, nasal, zygomatic arch, Le Fort II and lastly Naso Orbito Ethmoidal (NOE) fractures. A study done at Greece showed a different result with zygoma fracture as a predominant fracture, followed by Le Fort II, NOE, Le Fort III, nasal, LeFort I, palatal split and finally dentoalveolar fractures [17].

Beaumont [8] also noted that the zygomaticomaxillary complex had the highest distribution.
Ferreira et al [19] had done a study of midfacial fractures in children and adolescents and found prevalence among facial fractures as zygoma followed by alveolar, Le Fort, orbital floor and finally hard palate.

N. Elhammali et al [21] had done a study of the incidence of sports related faciomaxillary injuries in 3596 patients over a 6 year period. Out of 3596 patients, 147 (4%) were sports related. The highest incidence was in the 20 – 29 yrs age group.

There was a significant prevalence of midface complex injury in (67%) of patients followed by mandible and skull base. In this study, injury to brain stem (19%) was the most common associated injury followed by soft tissue (16%) and dental injury (8%).

Basem T. Jamal [22] had done a study of 96 patients with ZMC fracture over a period of ten years (1996 -2006) and studied the association of ocular injuries with ZMC fracture. They found that the common etiology of ZMC fracture was assault (56%) followed by fall (24%). Out of 96 patients (66.6%) had minor ocular injuries. Subconjunctival haemorrhage was the most common symptom. So ZMC fracture has to be evaluated for ocular injuries.

Hanna Thoren [23] in their study of 401 patients during 2003 to 2004, found 101 patients had associated injuries with facial injury. Limb injury was common (13.5%) followed by brain (11.5%) and chest (5.5%).
Associated injuries are significantly correlated with mechanism of injury and fracture type. High speed accidents and severe facial fractures are significant predictors of associated injury.

In retrospective study done at Nora Medical University by Kazubiko Yamamoto [24] facio-maxillary injury after fall was analysed. In this 51.3yrs was the mean age for fall on the land surface and 31.9 yrs mean age had a fall from great height. Mandible fracture was the most common injury followed by midface fracture. In midface, zygoma was most frequently involved.

In a study done by Kai.H. Lee [25] at Christ church hospital during a 11 yr period (1996-2006) there was an increased number of fractures due to interpersonal violence. Age variation was 9 to 89 yrs, male female ratio was 9:1. Maximum number of patients belonged to the age of 16-30 yrs. About 619 patients (53%0 had midface fracture followed by mandible. Zygoma fracture was maximum (33%) and Le Fort fracture was minimum (3%). In interpersonal violence, 92 % of male patients had consumed alcohol and 20% in the case of non interpersonal violence.

A study done by S.Laverick [26] showed decline in facio-maxillary injury due to RTA and increase in interpersonal violence. Interpersonal violence was highly associated with alcohol consumption. 73% of men and 64% of women with alcohol consumption had faciomaxillary injuries due to interpersonal violence. Male female ratio was 8.4:1. Peak referral was
between 21-25 yrs. 28% of trauma was due to fall and 24% was due to alcohol consumption.

Hwang K.Yon [27] did analyses of facial bone fractures in a study of 2094 patients in 11 years and showed male are at high risk than women. In this study nasal fracture were more common followed by zygoma fracture. The causes of these fractures was blunt trauma due to assault than RTA followed by sports injury.

3.1. HISTORY OF MIDFACIAL FRACTURES AND THEIR MANAGEMENT

Midfacial fractures were mentioned in the very early writings of Edwin Smith Papyrus in 1650 BC [1,2]. Traditionally healing and religion were closely interwined as illustrated in the Hellenic period at the temples of Asklepios, where assistants to the priest provided medical care. A son was born to one of these assistants in 460 BC who was named as Hippocrates. He who is known as the “father of medicine” described various facial injuries around 400 BC. He was the one who provided the basis for bandages and single jaw interdental wiring as methods of fixation and stabilization of facial fractures [3].

In the nineteenth century Charles Fredrick Reiche [2] provided the first detailed treatise of maxillary fractures. Carl Van Graef[e2] reported on the use of an elastic tube placed in to the nose to maintain patency of air way and also described the use of head frame to treat the maxillary

In 1901 a French surgeon Rene Le Fort [4] published his classical paper on midfacial fracture patterns. He inflicted blunt facial trauma on 35 cadavers and then subsequently removed the soft tissue and examined the fracture pattern of the facial skeleton. This study is the basis for the description of maxillary fractures.

Zygoma fracture was not adequately mentioned during Hippocrates period. In 1906 Lothrop [5] was the first to describe the use of an antrostomy approach to describe the intraoral approach to the zygomatic arch. In 1927 Gillies [5] described a technique to elevate a depressed fracture of zygomatic arch as well as to manipulate a fractured zygoma.

In 1942 Adam [6] utilized wiring to obtain better stability of zygomatic fractures. For many years his protocol was followed in many institutions.

In 1970 Osteosynthesis became a reality for facial fractures with the Swiss Arbeitsgemeinschaft fur Osteosynthesefragen developing miniplate fixation. Today the use of miniplate provides the principle modality of treatment for reduction and fixation of displaced mid facial fractures for better aesthetic and functional outcome.
3.2. APPLIED ANATOMY OF MIDFACIAL BONES

This region may be more accurately defined as that area bounded above by a transverse line connecting the two zygomatico-frontal sutures, passing through the frontomaxillary and fronto-nasal sutures, and limited below by the incisal and occlusal plane of the maxillary teeth.

Posteriorly, the region is demarcated by the spheno-ethmoidal junction but includes the free margin of the pterygoid laminae of the sphenoid bone inferiorly.

The mid face is composed of the nasal, zygoma, maxillae, ethmoid and its conchae, palatine, inferior concha and vomer which are collectively referred to as the mid facial skeleton. These facial bones are comparatively fragile but gain strength and support as they articulate with each other[2,28]. It is this strength gained from each other that has often been described as the facial buttresses which Manson [29] alluded to when describing the vertical and horizontal struts that support the facial skeleton (Fig. 1).

Fig 1 A&B. Facial buttress of the midface & architectural model.
The vertical pillars (Fig. 2) are formed firstly medially by the piriform rims which continue superiorly as the frontal process of the maxilla. Secondly the zygomatic buttresses which continue superiorly with the lateral orbital rims form the lateral pillars and finally the most caudal pillars are the pterygoid plates.

Figure 2. Vertical pillars

The horizontal pillars (Fig. 3) are formed by the frontal bar composed of the supraorbital rims and nasal process of the frontal bone, the zygomatic arch, infraorbital rims, and the nasal bridge and finally the alveolar process of the maxilla. The maxillary, palatine, ethmoid, vomer, lacrimal and body of the sphenoid bones are clothed in mucosa over large area of their surfaces. Thus all fractures are compound in nature. The blood supply to any part of the midface skeleton is never in doubt in spite of gross comminution as all the fragments of the bone retain periosteal blood supply.
The name zygoma is derived from the Greek word Zygoun “a Yoke” which means - to join - (i.e like a crossbar or bridge) where it articulates with the temporal, maxillary, frontal and sphenoid bones. It is described as a diamond or pyramidal shape bone, of which the lateral surface is convex forming the prominence of the cheek. The posterior surface contributes to the temporal fossa. Projecting superiorly is the frontal process which articulates with the zygomatic process of the frontal bone in front and greater wing of sphenoid behind to form the lateral wall and rim of the orbit. Posterolaterally the temporal process articulates with the zygomatic process of the temporal bone to form the zygomatic arch. Inferiorly and medially it broadly articulates with the maxilla to form the inferior orbital rim and contributes to the orbital floor as well, as the zygomatico maxillary buttress which forms one of the struts mentioned above. [30]
The anatomy of the maxillae

The two maxillae - sometimes referred to as the maxilla (upper jaw) comprise the essential bones of the central middle third of the face. They are most readily considered together. The horseshoe-shaped upper alveolar process is more delicate than that of the mandible, since it lacks a substantial cortical margin, but strength is conferred by the palatal shelves which unite the alveolar process all around. Above the alveolus, each bone has a roughly triangular shape with a medial wall comprising the bulk of the skeleton of the lateral nasal wall, the anterolateral surface and the posterior surface. These three surfaces form the vertical walls of the maxillary antrum, of which the floor is the alveolar process and the roof the orbital plate of the maxillary bone. The antero-lateral and posterolateral wall meet at the zygomatico maxillary suture line.

The ethmoid bone

This voluminous but featherweight bone comprises most of the roof of the nose, contributing minimally to the floor of the anterior cranial fossa, and to the medial walls of the orbits and thus part of the lateral wall of the nose. The perpendicular plate forms part of the bony nasal septum and projects above into the front of the anterior cranial fossa as the crista galli. The most important point to note is that the olfactory nerves enter the nose through the cribriform plate, the foramina allowing contact with the dura above and the nasal periosteum below. The olfactory nerves, an extension of the brain, do not regenerate and post-traumatic anosmia will,
therefore, be permanent. The dura and nasal mucoperiosteum are also almost in contact over the roof of the superior ethmoid air sinuses. Any fracture involving these areas is liable to open the nasal cavity to the subarachnoid space, thus leading to cerebrospinal fluid rhinorrhoea and the opportunity for meningeal infection.

The Pterygo-Palatine Region

The palatine bone effectively completes the posteromedial corner of the maxila on each side, contributing to the palate and the lateral wall of the nose. Behind, it is supported by the strong pterygoid plates of the sphenoid bone. These are substantial, since they form the only origin in the central middle third for muscles of any substance.

The Nasal Septum

This is made up of the vomer, the perpendicular plate of the ethmoid and the septal cartilage. The latter does not contribute materially in resistance to applied forces since being thin and flexible, its articulation in the nasal floor is weak. The bony component of the septum is not much stronger, being paper-thin. The lateral nasal wall is made up basically of the maxilla, the ethmoid and the perpendicular plate of the palatine bone, with minor contributions from both the inferior conchae and the nasal bones.
**The external nasal skeleton**

Two of the previously mentioned buttresses of strong bone form vertical pillars in the plane of the thin lateral nasal wall at its anterior and posterior end. The external nasal skeleton is found on the pyriform aperture made up of alveolar and frontal processes, of maxillae, the nasal bones and the upper and lower (alar) cartilages. The tip of the nose is largely supported by the septal cartilage, the alar and nasal cartilages being unimportant in this context.

**ANATOMY - LATERAL MIDDLE THIRD OF FACE (ZYGOMATICO-MAXILLARY COMPLEX)**

The zygomatic bone is a thick strong bone which forms the key to the structure of the anterolateral surface of the face. It forms one of the principal means by which occlusal stress is transmitted from the maxilla and spread over the base of the skull. Being prominent it is frequently subjected to injuring force and so ‘fracture of the zygoma’ is second among the common fractures of the middle third of the face, being only slightly less common than isolated fractures of the nose. The body of the zygomatic bone articulates with the maxilla and its orbital plate. The apex of the maxillary antrum lies immediately beneath the zygomatico-maxillary suture and so the body of the zygomatic bone is supported only by thin anterolateral and posterior walls and orbital plate of the maxilla.

The remainder of the zygomatic bone articulates with the greater wing of the sphenoid bone at the lateral extremity of the inferior orbital
fissure. The frontal process is a thick triangle of bone with an orbital, facial and a temporal surface. The flat temporal process projects backwards to form the anterior part of the zygomatic arch. The junctions of the frontal and the temporal processes of the zygomatic bone form an important landmark in the treatment of maxillofacial injuries since they are readily palpable and mark the spot immediately below and in front of the point of insertion of an awl for the passage of a circum-zygomatic wire. The anterior inferior end of the bone is marked by a tubercle for the anterior end of the masseter whose origin extends backwards along the temporal process.

In the present context the most important structure attached to the zygomatic bone is, however, the temporal fascia. This extremely dense sheet of connective tissue is attached along the junction of the facial and temporal surface of the frontal process and right along the superior surface of the temporal process. The fascia above is attached to the superior temporal line of the frontal and temporal bones but divides 2 cm above the upper margin of the arch into a superficial and deep layer. Inferiorly, there is dense fusion between the periosteum, the outer layer of the temporal fascia and the superficial fascia over the lateral aspect of the zygomatic arch. The importance of the relationships between these layers for surgical approaches has been pointed out by various authors. The fascial attachment, together with the periosteum, limits the displacement which the zygomatic bone suffers following injury. Should these structures be
ruptured gross posteroinferior displacement as a result of masseteric contraction would occur.

3.3. PATHOLOGICAL ANATOMY OF FRACTURES
MIDDLE THIRD OF FACE

It is customary to describe fracture lines of the central middle third with respect to the Le Fort lines. It must be recognised that this is a convenient form of 'surgical shorthand' of great practical help when planning treatment. Comminution maybe severe, but tends to follow the LeFort lines in general, and the essential point to establish is the level above which the midfacial skeleton is intact, since fixation must be to a stable bone.

Le Fort I level fractures (Guerin's fracture)

This is a horizontal fracture line above the level of all the roots of maxillary teeth and below the zygomatic buttress, and the mobile fragment consists of the pterygoid plates and associated portions of the palatine bones (Fig. 4).

Figure 4. Le Fort I fracture.
Le Fort II level fractures

These are pyramidal in disposition. The mobile central pyramidal fragment consists of most of the maxillary bones on each side of the nasal bones. From the nasal bridge the fracture invariably enters the medial wall of the orbit, involving the lacrimal bone, and then recrosses the inferior orbital rim at the junction of the medial third and the lateral two thirds, skirting medial to, or through, the infra-orbital foramen. The fracture line runs beneath the zygomatic maxillary suture, traversing the lateral wall of the antrum to extend backwards horizontally through the pterygoid plates. The zygomatic bones and arches remain attached to the skull base and only the infero-medial corner of the orbital rim is involved (Fig. 5).

Figure 5. LeFort II fracture.

Le Fort III level fractures

These essentially run parallel with the base of the skull, separating the whole of the mid-facial skeleton from the cranial base. The fracture extends through the nasal base and continues posteriorly through the full depth of the ethmoid bone. The fracture then crosses the lesser wing of the sphenoid and may very rarely involve the optic foramen. However, it slopes downwards medially, passing below the optic foramen to reach the
pterygo-maxillary fissure and sphenoid-palatine fossa. From the base of the inferior orbital fissure the line of the fracture runs out laterally and upwards separating the greater wing of the sphenoid bone and the zygomatic bone to reach the frontozygomatic suture. It also extends downwards and backwards across the sphenoid-palatine fossa to involve the root of the pterygoid plates (Fig. 6). The zygomatic arch is also fractured, usually through the weakest point adjacent to the zygomatico-temporal suture.

Figure 6. LeFort III fracture.

Although these three fracture lines have been described as if invariably symmetrically distributed about the face; it is not uncommon for
unilateral combinations of them to occur; for instance the level may be LeFort I on the left and also associated with a Le Fort II pyramidal type of fracture to the right.

Central Split of the palate

This is not common and is in fact a paramedian line of fracture since the sutural interface is relatively strong and may be seen in combination with any of the three previously described levels of fracture. Inevitably because the palate is covered by densely adherent mucoperiosteum, which is ruptured, the oral and nasal cavities are in communication, although in many cases the nasal mucosa appears to remain intact.

Displacement of central middle third fractures

The majority of these injuries result from a force applied anteriorly over a wide area, as in road traffic accidents. Occasionally a lateral force is the cause, and quite exceptionally, a small mass travelling at high velocity is responsible. The force producing the injury also acts as the displacing force and all subsequent soft tissue activity tends to reduce the fracture, except possibly the pull of the pterygoid muscles. The origins of these muscles are always involved in these fractures but invariably the bulk of the origin, including the upper head of the lateral pterygoid muscle, remains undisturbed. As the fragments are displaced backwards, there is a general tendency for them to move downward also. With high level fractures the downward movement is influenced by the general slope of the cranial base. In Le Fort II level fractures the downward movement will be
affected by the general disposition of the fracture line. In Le Fort I level fractures the downward displacement is minimal unless gross comminution with rupture of the embracing periosteum allows sagging under the influence of gravity.

All these fractures are open to the nose, paranasal sinuses or mouth and thus predisposes to potential infection. All Le Fort III and some Le Fort II level fractures involve comminution of the cribriform plate and thus open the subarachnoid space to the nasal cavity. An extension of an associated fracture of the floor of the anterior cranial fossa may have the same effect. Such injuries may also be associated with the passage of air into the subarachnoid space thus giving rise to an aerocele. In level II and III fractures there will be injury to the suspensory ligament on the medial wall and sagging of orbital contents.

Lateral forces accounts for most nasal fractures and produce wide variation, depending on the age and direction of force.

Younger patients tend to have fracture dislocation of larger segments whereas in older patients with more dense brittle bones, comminution is observed more frequently. Kazanjian & Converse (1959) have confirmed that most nasal fractures occur in the thin portions of the nasal bones, 80% in their series.
Violent blows result in fracture of nasal bones, frontal processes of maxilla, septal cartilage and ethmoidal area. The bones are driven into ethmoidal area resulting in broadening, and widening of inter orbital space producing telecanthus.

Nasoethmoidal fracture occur with a wide variety of combinations with associated fractures of adjacent bones, such as frontal, zygoma and maxilla. Fractures and dislocations of septal cartilage may occur independently or concomitantlly with fracture of nasal bones. In severe injuries, caudal portion of septum which is flexible to mild and moderate impact, fractures and dislocates from the vomerine groove. Angulation of the caudal border of the septum can be, indicative of septal fractures.

**Depressed fracture of the zygomatic - maxillary complex**

In this common injury the feature is displacement without isolated fracture of the zygomatic bone itself. There is seperation at both the zygomatico-frontal suture and in proximity to the zygomatico-temporal suture line. The major damage is sustained by the lateral wall of the maxilla, which is fractured in close proximity to its attachment to the zygomatic bone, often with comminution. The fracture line is completed by separation from the greater wing of the sphenoid bone. Intrusion of the zygomatic bone into the lateral wall of the maxilla leads to damage to the infra-orbital nerve. The zygomatic bone being subcutaneous may be readily felt, or seen to be displaced at the fracture line adjacent to the fronto-zygomatic suture and also in the inferior orbital margin. The
fracture is, however felt most readily intra-orally due to the thinness of the oral mucosa over the zygomatic buttress of the maxilla above the upper first molar. This fracture is open (compound) into the maxillary antrum which, however, is normally a sterile cavity.

**Fracture of the zygomatic arch**

This is comparatively an unusual injury produced by an impact delivered over a small area. The arch fractures at one or more of the following three sites: in proximity to the zygomatico temporal suture; at the junction of the body and temporal process of the zygomatic bone, and through the zygomatic process of the temporal bone anterior to the glenoid eminence(Fig. 7). The arch is normally protected from vertical displacement by the temporal fascia for the reasons already explained. The displaced arch, tends to impinge upon the tendon of the temporalis muscle as it converges to the coronoid process.

![Figure 7. Fracture Zygoma.](image)
Fracture of the Frontal Process

Fracture of the process of the zygomatic bone may occur in conjunction with comminuted fracture of the orbital rim and frontal bone, either above at the frontozygomatic suture or lower down at the base.

CLASSIFICATION

Zygomatic Fractures

The earliest classification of zygoma fracture was based on where the broken zygoma was attached after the fracture. This was coined by Schjelderup [44]. For example type III fracture means - when the zygoma was hinged at the frontal bone.

In 1961 zygoma fracture was classified as 6 types by Knight and North [44].

Type I  - undisplaced fracture.
Type II  - isolated arch fracture.
Type III - posteriorly displaced fracture.
Type IV  - medially rotated.
Type V   - laterally rotated at the buttress.
Type VI  - multiple or comminuted fracture including the body.

Based on the axis of rotation in vertical or horizontal plane in 1968 Rowe and Killey [44] classified zygoma fracture into 8 types. The fracture from frontozygomatic to first molar plane as the vertical axis and fractures from infra orbital foramen to zygomatic arch plane as the horizontal axis.
Larsen and Thomsen [44] classified zygoma fracture as group A to C. Group A is no or minimally displaced fracture. Group B fracture requires reduction and fixation. Group C includes fractures that require reduction but no fixation.

Manson and Markowitz [45] in 1990 classified fracture as low, middle and high energy fracture based on the severity of the blow to the bone. Low energy injuries account for 18% characterised by no or minimal displacement which required no or minimal stabilisation.

Middle energy fracture (77%) which ranged from mild to marked with complete separation of all four sutures required rigid fixation. High energy injuries are highly comminuted displaced which needs reduction and fixation and at times correction with bone graft.

MAXILLARY FRACTURES

Le Fort classified fracture pattern in to I, II & III. [2,46]

Le Fort I extends horizontally from piriform rim laterally above the apices of teeth along the alveolar process continuing below the zygomatic buttress to involve the pterigoid plates. This results in disarticulation of the occlusal unit from the mid face.

Le Fort II extends from nasal bones to involve the medial and infraorbital rim, anterior wall of maxilla, zygomatic buttress, and pterigoid
plates. This fracture results in mobility of mid face from cranial base with lengthening of base.

Le Fort III extends from the frontonasal region in the midline, involving the medial floor and lateral wall of the orbit, the frontozygomatic suture and maxilla which extends to the upper pterigoid plates. This results in disarticulation of the facial bones from the cranial base.

**NASO ORBITO ETHMOID FRACTURES [NOE]**

These fractures are the most complex fractures because of its difficult anatomy and fixation. Gruss [47] stated that due to its complex nature numerous classifications were proposed for NOE fractures. Classification proposed by Markowitz et al [48] has been adopted as the most relevant classification of NOE fractures.

They defined the area of attachment of the medial canthus to the bone as the “central fragment” which is critical for the diagnosis and treatment of NOE fractures.

Type I produce a single segment fracture of the central fragment (Fig. 8).
Type II has a comminuted central fragment with the fractures remaining external to the medial canthal insertion (Fig. 9).

Type III has a comminuted central fragment with involvement of the canthal insertion (Fig. 10).
3.4. INVESTIGATIONS

THE STANDARD RADIOGRAPHIC PROJECTIONS

1. Brow-up lateral projection of face and skull.
2. Occipitomental 45° projection
4. Chest X-ray to exclude injury and demonstrate the possible presence of inhaled foreign bodies (eg. tooth).

The occipitomental view is the most useful for the fractures occurring in middle third of face. However it is important to compare the findings in these projections with those in the other views. McGrigor and Campbell in 1950 had described `four curvilinear lines' of interpretation of this view (Fig. 11).
In areas of interpretative difficulties such as fronto-nasoethmoidal regions technically specialised methods such as C.T. scan have been involved, especially when associated with head injuries.

GUIDELINES TO USE CT SCAN IN MIDFACE FRACTURES

In the use of computerised tomography for evaluation of head and maxillofacial injuries, the following general points should be considered. The patient's clinical state and the potential diagnosis must be taken as the deciding factor for the need, and the urgency of that need, in requesting a CT examination. It is necessary to determine whether there are any absolute indications for CT scanning or whether it would be expedient to utilise this technique during the performance of other diagnostic investigations. Certainly, in the case of head injuries, absolute indications exist, and these are found in patients with cranio-cerebral trauma whose condition is deteriorating. The presence of haematoma formation and
cerebral oedema, either focal or generalized must be established, as early
diagnosis permits early treatment, thus averting irreversible brain damage.

There is no absolute indication for CT scanning for maxillofacial
injuries. However in those patients with combined head and upper face
injuries, with or without cerebrospinal fluid leaks, CT examination of the
upper and mid-face regions should also be done.

This is usually done within the first few hours following the injury.
The extension of this scan into the facial region does not add greatly to the
scan time nor will it aggravate further the patient's condition unless the
deterioration in the clinical state is unduly rapid. The diagnostic result
from this early evaluation of the combined injuries has proved to be
extremely useful both to the neurosurgeon and maxillofacial surgeon in
planning the treatment. However, this approach depends entirely on the
close cooperation and recognition of the needs of both specialties and on
the skill of the radiologist and his team.

The relative indications for CT scanning usually arise from
consideration, once the acute resuscitative phase of the patient's treatment
has been accomplished. Standard plain radiographs should always be
available and these, together with the clinical information, form a basis for
a decision as to the need for supplemental investigations. CT is not the
investigation of first choice in all cases of midface trauma. Where cheaper
and more readily available conventional methods of investigation are able to give a satisfactory diagnostic answer, then of course, they must be used.

3.5. THE MANAGEMENT OF THE FRACTURES OF MID FACE

The management of the patient who has sustained a midface injury can be divided into four main stages of treatment:

1. First aid and resuscitation. 2. Initial assessment.
3. Definitive treatment. 4. Rehabilitation.

First aid and resuscitation

Emergency treatment immediately following injury necessitates the performance of life-saving procedure including the maintenance of the airway, the control of haemorrhage and the management of any associated head injury. The assessment and treatment of such problems have been dealt with comprehensively.

Initial Assessment

Once the general condition of the patient is stable, the initial assessment of the maxillofacial injury can be carried out. The information required to formulate a diagnosis and devise a definitive treatment plan is as follows: 1. History 2. Clinical Examination 3. Radiological examination 4. Special investigations.
The nature and exact time when the injury was sustained should be carefully recorded together with the physical signs. These aspects and the radiological assessment have already been described in detail.

It is however, important that impressions of the teeth are taken for preparing splints. These can then be used to determine the occlusion and to fabricate any necessary individually-constructed arch bars or silver cap splints.

**Definitive Treatment**

The diagnosis having been made, a definitive treatment plan is now required so that all necessary procedures both preoperative and operative are performed in an orderly sequence.

**Pre - Operative Planning**

There are four main essentials to decide before operative reduction and immobilisation of the mid-face fracture.

1. The type of fixation required, i.e. internal or external skeletal fixation.
2. The need for open reduction and the application of direct transosseous wiring or bone plate.
3. The type of intermaxillary fixation required i.e interdental eyelets, arch bars, cap splints or ‘Gunning-type' splints.
4. The need for tracheostomy; this should be agreed upon by the anaesthesiologist.
INTERNAL SKELETAL FIXATION

The stabilisation of fractures of the middle third of the facial skeleton may be effected by any combination of direct transosseous wiring, internal suspension to or by transfixation with Kirschner or Steinmann pins. Now with mini-bone-plate osteosynthesis (with or without the facility for compression) more rigid, stable and accurate reduction can be achieved.

Transosseous wiring


When the fracture does not occur at a normal suture line the commoner sites for direct wiring are: 1.Inferior and lateral orbital margins 2.Superior orbital margin 3.Zygomatic arch 4. Palatal processes of the maxillae.

When a fracture involves the palatal process of one of the maxillary bones, a so-called `midline split' of the palate results. The fracture and separation, if it is displaced, actually occurs lateral to the midline. Direct transosseous wiring across the free edges of the fractured palatal process may provide additional stability and obviate the complication of a cross-bite due to an increase in width between the posterior teeth and maxillary
tuberosities. The procedure is effected following disimpaction and reduction of the maxillae. The mucoperiosteum on both palatal and nasal aspects of the palatal process is raised to expose the bone, which is then drilled with a small round burr at an adequate distance from the fracture line to provide stability and to prevent cut through when the wire is twisted and tightened. On occasions, approximation of the bone edges posteriorly may be difficult and this can be assisted by means of the special forceps described by Hayton Williams. The mucosa on the palatal aspect is then sutured.

**Transfixation with Kirschner wire**

Although facial transfixation in the treatment of maxillofacial injuries using Kirschner wires is not a widely accepted technique, this method, is nevertheless valuable, in the control of middle third facial fracture since it is both simple and quickly executed. Further, no special laboratory facilities are needed and hence it is suitable for use in remote hospitals, or in war front conditions. It must be recognised however, that facial transfixation is not a universally applicable system for the treatment of all mid-facial fractures.

**INTERNAL SKELETAL SUSPENSION**

In 1942, Adams introduced a new method of treating fractures of the middle third of the facial skeleton, the underlying principle of which was to suspend a mobile part below to a firm stable part above the fracture by means of a subcutaneous wire (Fig. 12). This proved to be a big advance in
the control of such fractures and the method has stood the test of time. The stable point of fixation which he described was to the zygomatic process of the frontal bone above the frontozygomatic suture, which is now termed lateral frontal suspension. The advantages of internal skeletal suspension are twofold: from the patient's point of view it is comfortable, well-tolerated and inconspicuous; and the surgeon finds the technique rapid, accurate and dependable, furthermore, technical facilities are not required.

![Figure 12. Internal skeletal suspension](image)

However, this method of suspension, and likewise circumzygomatic suspension, have the disadvantage of applying an oblique upward and backward pull to the reduced maxillae which may lead to subsequent displacement. This is particularly evident in the presence of an unstable middle-third complex associated with bilateral fractures of the mandibular condyles. A stable mandibular platform, together with adequate intercuspal interdigitation, is an essential requirement. In order to provide a means of more direct vertical suspension with a slightly forward pull, Kufner (1970)
[40], introduced his method of cranio-facial suspension, now termed central frontal suspension, provided that the frontal bone is intact, so that a fixed stable point in taken above the frontal sinus.

**Disadvantages of internal skeletal suspension**

Internal wire suspension is not a rigid method of fixation. This disadvantage is now being overcome by the development and use of miniplate osteosynthesis. This combines both direct fracture reduction and skeletal fixation. Lateral frontal and circumzygomatic suspension exert a backward and upward pull which can result in recurrence of the malocclusion following removal of the intermaxillary fixation. A more vertical method of suspension can be achieved by central frontal suspension which may be combined with the attachment of lateral frontal or circumzygomatic suspension to the posterior end of the maxillary arch bar.

**Bone plate osteosynthesis**

The use of metallic bone plates for the stabilisation of facial fractures has been developed during the last two decades. The initial impetus stems from the successful use of small bone plates in the treatment of fractures of the mandible. Since then various systems of plates and instruments have been devised and the techniques of application refined, some of which incorporate the facility for compression.
Subsequently, the application of screwed bone plates has found favour, particularly in the continent of Europe, for osteosynthesis of mid-face fractures (Fig. 13). The larger plates used for fractures of the mandible have been reduced in size and this has led to the development of various systems of miniature screws and plates. Michelet et al, (1973)[36] used stellite plates made of vitallium and Peri et al (1973) devised plates which could be shaped bi-dimensionally and could be cut to the required length. Metal bulk was reduced to the absolute minimum by incorporating multiple holes through which screws could be passed.

There is little doubt that the use of miniature bone plates provide increased stability of mid-face fractures following reduction when compared with other methods of suspension and fixation. Correct application may obviate the need for additional internal skeletal suspension or external skeletal fixation, and the need for intermaxillary fixation, particularly when the mandible is intact. The view that osteosynthesis
using screwed plates provides reliable fixation in all planes, and almost eliminates additional fixation is supported by others. However, no one method of fixation can encompass, to the exclusion of all other methods, all the eventualities which may occur when treating pan-facial fractures.

With the more severe midface fracture, osteosynthesis of the facial skeleton, commenced at the periphery and proceeded towards the centre. Fractures involving the mandible and fronto-zygomatic sutures should therefore be stabilised initially followed by reconstruction of the mid-face area. Subsequently, with improved techniques, the system has been applied to the treatment of naso-ethmoid injuries also.

The frontal process of maxillary bone is thus aligned and fixed to the frontal bone providing stability to the former by preventing rotation, particularly in the presence of underlying comminution of the ethmoid bones which may not be adequately controlled by steel wire osteosynthesis. Plating at this site also provides rigid vertical anterior support for Le Fort II and III fractures.

There are thus several sites of selection which have proved particularly satisfactory for the localisation of miniaturized bone plate for the alignment and stabilisation of mid-face fractures.

The possible disadvantage of these bone plate systems is that a special kit of instruments are required, together with a range of plates and
screws which is relatively expensive when compared with the cost of stainless steel wire. In the last few years there were improvements in the osteosynthesis. After miniplates, 3 dimensional plates were used. These plates were fixed with screws in all the four corners. This gave good strength after fixation, but it was not possible to use these plates in severe comminuted fractures in midface.

Locking plates are designed with locking threads in the plates and screws which can fix the maxillo facial fractures [11]. In conventional plates when the plates are fixed on the bone it has to be bent according to the contour. When fixing there will be torsion and gaping in the bony fragment when tightening the plates with screw. But in locking plates it need not be contoured as precisely as conventional plates. These locking plates prevents stripping movements and loosening of screws, and there is no pressure on the bone so there is no vascular compromise and there is good blood supply to periosteum.

Bio sorb FX plates and screws are biodegradable self reinforced poly (L/DL) lactic acid copolymer system which gets absorbed in four years time[15]. These are available in 1.5 mm and 2.0mm size. There is no need for any plate removal in future and these are highly biocompatible. But intraoperative handling is not as easy as conventional mini plates.

Recently micro plates and screws are available in 1.3mm and 0.5mm size with screw length of 6mm and 8mm [18]. These are easy to handle
and can be introduced into smaller narrower regions. Since they are not palpable they are used in areas with mucosal cover over frontal, nasal, maxillary sinuses, frontozygomatic regions and in midface fractures when compared to miniplate which is bulky at these sites.

**General Principles in the treatment of Zygomatic fractures**

1) **No treatment** - There are an appreciable number of patients for whom no treatment is considered necessary. Apart from medical contraindications such cases are essentially those with a minimal degree of displacement, which following union, are considered unlikely to result in any cosmetic deformity, visual disturbance, persistence paresthesia or impairment of mandibular movement,

Isolated zygomatic fractures associated with severe edema and periorbital echymosis are treated after a delay of 7 to 10 days. This gives time for the soft tissue swelling to subside and also one can easily assess the facial asymmetry and also find out other fractures by doing CT scan [Zingg et al., 1991][54].

If there is aesthetic and functional deformity, fracture reduction should be done. In a literature review 94% of Zygomatico Maxillary complex [ZMC] fracture required surgical reduction [Knight,1961; Yanagesawa,1973; Ellis 1985] [55,56].
2) **Indirect Reduction** - The principle is to disimpact and reduce the fracture by direct application of an instrument deep to the temporal aspect of the zygomatic bone through an indirect approach remote from fracture line. The approaches are:

- Temporal approach (Gillies).
- Upper buccal sulcus approach-(Keen and Subramaniam).
- Lateral eyebrow approach-(Dingman).
- Percutaneous hook tractions-Strahmeyer hook, Poswillo hook, Caroll-Girard screws.
- Intranasal and transnasal approach has been employed by some Otorhinolaryngologists but is not in common use.


3) **Direct fixation** - Indirect reductions, combined with direct fixation following the exposure of the fracture site, provides an excellent method in fractures considered likely to remain unstable after reduction, using transosseous wiring and miniplate osteosynthesis. Controversy exists regarding the need of one, two and three point fixation. Many studies showed greatest stability in three point fixation with mini plates. One study [Davidson 1990][59] showed single point miniplate fixation at fronto zygomatic suture line or the infraorbital rim which can achieve stable
fixation. Miniplates add stabilization in all spatial planes, inhibiting rotation and distraction and produce hinging at the fracture site. [Zingg et al 1992][57]. Resorbable plates have the same advantages as titanium plates however they are absorbed within 3 to 12 months. The main indication of absorbable plates are its usage in pediatric population where long term facial growth is of main concern. They are also useful in comminuted fractures because they can offer multiple sites for insertion of screws. Eisel et al 2001[60] has designed a new mini dynamic compression plating system for zygoma fracture which gives single point stabilization.

Kirmal et al 2002 [49] reported good results in malar fracture repair with minimal incision and endoscopic assistance in 12 patients. In 9 cases repositioning was excellent. 2 cases had minimal dislocation and in one case revision was done. In all cases frontal nerve branch was intact with very minimal scar, but operating time was very long. Lee et al 1997 [50] have also done endoscopically assisted surgery and found advantages when compared to approaches through bicoronal incision to repair comminuted fractures.

4) **Indirect fixation** - This term implies that the zygomatic bone will be rigidly secured to some point elsewhere on facial skeleton until union occurs after which connecting apparatus may be removed.

Indirect fixation has only limited application at the present time in view of the greater efficiency and comfort obtained by internal fixation
techniques However, the techniques does provide a means of fixation when there has been gross loss of bone in the region of fronto-zygomatic fixture and inferior orbital rim. The following methods will be considered: a) Zygomatico- Zygomatic, b) Naso- Zygomatic, c) Zygomatico- Palatine, d) Maxillo- Zygomatic, e) Fronto- Zygomatic, f) Cranio- Zygomatic.

**MANAGEMENT OF NASAL FRACTURE**

Management of nasal fracture is based on clinical assessment of function and appearance. Initial application of ice pack and head elevation can decrease the pain and edema. After this, proper assessment and reduction can be done. Reduction can be done within 5 to 10 days in adults and 3 to 7 days in children. Closed reduction is the first choice followed by open reduction which can be done if proper reduction cannot be achieved by closed method. The indication for closed reduction are fracture of the nasal complex that is deviated less than one half of the width of the nasal bridge.

There are four patterns of fractures:

1. Lateral displacement without septal fracture.
2. Lateral displacement with septal fracture.
3. Fracture of nasal cap.
Walsham’s forceps and Asch’s forceps are used in fracture reduction (Fig. 14). The small blade is introduced into the nose and large blade is applied externally to grip the side of the nose up to the medial canthus and parallel to the frontal process of the maxillary bone. Medial or lateral rotation will effect the in or out fracture of the appropriate nasal bone. While doing this manipulation the other hand’s index finger and thumb should grip the base of the nose to give additional stability.

![Image of Walsham forceps & nasal fracture reduction.](image)

**Figure 14. Walsham forceps & nasal fracture reduction.**

The septum is manipulated by Asch septal forceps. The blades are introduced into the floor of the nose on either side of the septum and gentle pressure is used to realign the septal cartilage. The blades are then rotated upwards and forwards to grip the septum and forward traction is applied to elevate the nasal bridge.
Indications for open reduction are:

- Extensive fractures.
- Deviation of nasal pyramid more than one half of the width of nasal bridge.
- Displaced fracture of the caudal septum.
- Open septal fracture.

Septum is the key structure which may get interlocked after fracture and prevent proper reduction. So removal of septum may be necessary to get adequate reduction. Dorsum of the nose is approached through intercartilaginous incisions and the septum stabilised with PDS sutures to the periosteum of the nasal spine. There was 30 to 40% failure rate in closed reduction done for bony and septal fractures of nose with deviation of more than half the width of nose. In a trial done by Murray et al 1984 [51] among two group of patients, manipulation only was done in one group and manipulation plus excision of septal cartilage was done for the other (closed versus open). This proved open reduction is a better treatment for patients with deviation of more than half the width of the bridge of nose. Merks et al [1977] did a study in 100 adults with severe fractures and found in the longterm, 30% of patients developed deviation of nose with obstruction in patients treated only with closed reduction, because of untreated green stick fracture of the nasal bone. Whereas only 1 of 17 patients had poor result after open reduction with septal correction.
MAXILLARY FRACTURES

Periorbital swelling and dish face deformity occurs after extensive LeFort II and III fractures in which the maxillary segment is displaced posteriorly and inferiorly resulting in anterior open bite deformity. In severe posterior displacement, it may obstruct the airway. Emergency disimpaction of the bony segment has to be done to restore airway patency, [Marciani et al 1993] [52]. Definitive treatment of Le Fort fractures are open reduction and fixation. After fixation, the midface projection and height, dental occlusion and masticatory function should be corrected [Manson et al 1999][53]. Maxillomandible Fixation (MMF) should be done before fixation of maxillary fractures. Dental occlusion has to be obtained which allows for perfect reconstruction. If there is associated mandible fracture it has to be fixed first followed by MMF, then repair of maxillary fracture should be done. For edentulous patients surgical splints or dentures fixed to the underlying bone with screws or with circum-mandibular or circumzygomatic wiring provides the base for stable fixation [Marciani et al 1993].

Le Fort I fractures are approached through gingivolabial incision. Fixation with plate in the nasomaxillary or zygomaticomaxillary buttress on each side is adequate.

Le Fort II is fixed through sublabial incision usually but may need another incision through subcilliary route. Usually fixation at
zygomaticomaxillary buttress is enough but if unstable, additional plates may be added to nasomaxillary buttress or infraorbital rim.

Le Fort III fractures are approached through bicoronal approach. The main principle is to stabilize the mobile segments with stable frontal bone above and mandible below. So maxillary segment is disimpacted first and MMF should be done. Usually bilateral zygomaticofrontal fixation with plates are enough but sometimes if the fracture is unstable, further fixation at nasomaxillary, nasofrontal, infraorbital rim and zygomatic arch are needed.
Materials & Methods
MATERIALS AND METHOD

The study was done during the period of October 2010 to December 2012, totally for a period of 27 months. 297 cases of facial injuries were referred to the Department of Plastic Surgery during this period. Out of which only 61 cases of midfacial fractures were taken up for study.

Proforma was prepared to study the various epidemiological factors like age, gender, occupation, causes of injuries, association of injuries with alcohol consumption, usage of helmet, type of fractures, and to analyse the outcome of results of early and late management of these midfacial fractures.

This dissertation was submitted for the approval of the Human Ethical committee and the approval was granted, [Ref no.493/MEI/2007].

Verbal explanation about the study was given to the patients who fulfilled the inclusion criteria. Patients history, symptoms & signs were recorded, photos were taken, their contact address and phone numbers were collected with their consent.
**INCLUSION CRITERIA**

Midfacial fractures were included as per Frost [28] in the area bounded by frontozygomatic and frontonasal sutures superiorly and occlusal plain inferiorly, pterigoid plates posteriorly, till the root of the zygomatic arch laterally. So all the patients with fractures in the above mentioned territory were included for the study.

**EXCLUSION CRITERIA**

Fractures involving Frontal bone and Mandible were excluded.

When patients were referred to our department all details were recorded in the proforma. Patients age, sex, occupation, residential address and contact number were noted first. Mode of injury was recorded as road traffic accidents (RTA), assault, fall, industrial accident and sports injury. In RTA option, whether the patient was a pedestrian, bike rider, or pillion rider was recorded. History of alcohol consumption during driving was noted. Usage of helmet during driving by the rider and pillion rider was recorded. The site of accident, whether occurred on the street, or road within the urban area, or on the national highway were recorded. Whether the accident had taken place during day time or night time was also recorded.

Thereafter symptoms were recorded as relevant to the midfacial fractures. These include pain, ear nose throat (ENT) bleeding, difficulty to open mouth, malocclusion, loss of sensation over infraorbital area and
others. All these patients were examined and the important signs were recorded like periorbital edema, diplopia, subconjunctival echymosis, step in infra orbital region and zygoma region, malar flattening, trismus and cerebrospinal fluid (CSF) rhinorhoea. Oral examination was done to look for palatal split, malocclusion, oral mucosa, floor of the mouth, loose or broken teeth.

Associated injuries were recorded and Ophthalmology, Neurology, Orthopedics and ENT opinions were obtained whenever necessary. Comorbid factors such as Diabetes Mellitus, Hypertension, Ischemic Heart Disease were recorded and opinion from the relevant speciality was obtained. Basic blood investigations, X-ray chest, electro cardio gram (ECG), X-ray paranasal sinus (PNS) view and CT Scan of facial bones were taken and reviewed in the following appointment. These patients were classified after review of X-ray and CT Scan as Dento alveolar fractures, Zygomatico Maxillary complex fractures, Nasal complex fractures and Maxillary Le Fort fractures.

According to the diagnosis relevant treatment was planned. The time gap between the day of injury and the day of surgical treatment was recorded. This duration was classified as within 7 days, between 7 days to 14days (early management), and later than 14 days (late management). Patients who had only midfacial fracture with no other injuries were referred early to our department and we have managed them early. Those
with associated injuries and other comorbid factors along with midfacial fractures were referred late after getting treatment for other injuries and our treatment was delayed. Some of the patients came to the hospital very late after taking treatment at other places. Some of the patients were managed conservatively.

Patients planned for surgery were referred to anesthesiologist for fitness. After getting consent, these patients were operated under local anesthiesia or general anesthesia (either through oral or nasal route) as per anesthesiologist advice. Various techniques of reduction, fixation of fractures with plates and with MMF were recorded. Proper photos were taken in the intra operative period, post operative period, and at the time of discharge.

Follow up was done after two weeks, after one month and after three months. During follow up, the cosmetic and functional results and complications were recorded. All the various demographic factors, etiology, type of treatment and results were analysed and compared with other similar results which was done by different authors.
Results
RESULTS

In a total of 61 patients, details of history, examination findings, operation records, follow up photos and the results were entered in the proforma (annexe.1). The master chart was then prepared and the results were analysed (annexe.2).

GENDER DISTRIBUTION

Out of 61 patients, 53 patients were males and 8 patients were females. Gender distribution revealed male predominance in a ratio of 5:1 (Fig. 15).

FIGURE 15. GENDER DISTRIBUTION
TABLE 1. AGE DISTRIBUTION AMONG MALE PATIENTS

<table>
<thead>
<tr>
<th>S.No</th>
<th>Age range</th>
<th>Number of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Below-20</td>
<td>1</td>
<td>1.8%</td>
</tr>
<tr>
<td>2</td>
<td>20-30</td>
<td>20</td>
<td>37.7%</td>
</tr>
<tr>
<td>3</td>
<td>31-40</td>
<td>16</td>
<td>30.2%</td>
</tr>
<tr>
<td>4</td>
<td>41-50</td>
<td>8</td>
<td>15.0%</td>
</tr>
<tr>
<td>5</td>
<td>51-60</td>
<td>6</td>
<td>11.3</td>
</tr>
<tr>
<td>6</td>
<td>Above-60</td>
<td>2</td>
<td>3.8%</td>
</tr>
</tbody>
</table>

Out of 53 male patients, 20 (37.7%) were involved in the age group of 20 to 30 yrs. It was followed by 16 patients in the 31 to 40 year age group. There were very less patients in both extremes of age group, that is below 20 and above 60 yrs. In the 20 to 30 yrs age group all were involved in road traffic accidents (Table 1) (Fig. 16).

FIGURE 16. AGE DISTRIBUTION AMONG MALE PATIENTS
TABLE 2. AGE DISTRIBUTION AMONG FEMALE PATIENTS

<table>
<thead>
<tr>
<th>S.No</th>
<th>Age range</th>
<th>Number of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Below-20</td>
<td>1</td>
<td>12.5%</td>
</tr>
<tr>
<td>2</td>
<td>20-30</td>
<td>2</td>
<td>25%</td>
</tr>
<tr>
<td>3</td>
<td>31-40</td>
<td>1</td>
<td>12.5%</td>
</tr>
<tr>
<td>4</td>
<td>41-50</td>
<td>4</td>
<td>50%</td>
</tr>
</tbody>
</table>

In the female population more number of patients (50%), were in the 41 to 50 yrs age group. The main cause of the injury was assault, followed by fall and lastly road traffic accidents. This pattern is very different from men (Table 2) (Fig. 17).

FIGURE 17. AGE DISTRIBUTION AMONG FEMALE PATIENTS
Main cause of injury was road traffic accidents (49.2%), followed by assault (18%). Out of 37 patients who were involved in the two wheeler accidents, bike riders were more than the pillion riders (Table 3) (Fig. 18).
TABLE 4. DISTRIBUTION OF PLACE OF OCCURRENCE OF INJURIES

<table>
<thead>
<tr>
<th>Place</th>
<th>No. of cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street</td>
<td>39</td>
<td>64.0%</td>
</tr>
<tr>
<td>Home</td>
<td>14</td>
<td>22.9%</td>
</tr>
<tr>
<td>Highway</td>
<td>6</td>
<td>9.8%</td>
</tr>
<tr>
<td>Work</td>
<td>2</td>
<td>3.3%</td>
</tr>
</tbody>
</table>

Majority of the injuries have taken place on the roads (64.0%), within the city and around the nearby villages. 22% of injuries have occurred at home due to assault and fall (Table 4) (Fig. 19).

FIGURE 19 . DISTRIBUTION OF PLACE OF OCCURRENCE OF INJURIES
TABLE 5. INCIDENCE OF ALCOHOL CONSUMPTION AND INJURY

<table>
<thead>
<tr>
<th>Habit</th>
<th>No. of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>30</td>
<td>49.2%</td>
</tr>
<tr>
<td>Non-Alcoholic</td>
<td>31</td>
<td>50.8%</td>
</tr>
</tbody>
</table>

Out of 61 cases 30 (49.1%) were under the influence of alcohol among all the cases of midface injury (Table 5) (Fig. 20).

FIGURE 20. INCIDENCE OF ALCOHOL CONSUMPTION AND INJURY
TABLE 6. USAGE OF HELMET

<table>
<thead>
<tr>
<th>Usage of Helmet</th>
<th>Number of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Helmet</td>
<td>2</td>
<td>5.4%</td>
</tr>
<tr>
<td>Without Helmet</td>
<td>35</td>
<td>94.6%</td>
</tr>
</tbody>
</table>

Out of 37 cases of road traffic accidents only two of them had used helmets (5.4%), rest of the 35 patients (94.6%) did not use helmet (Table 6) (Fig. 21).

FIGURE 21. USAGE OF HELMET

<table>
<thead>
<tr>
<th>Day / Night</th>
<th>No. of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>32</td>
<td>52.5%</td>
</tr>
<tr>
<td>Night</td>
<td>29</td>
<td>47.5%</td>
</tr>
</tbody>
</table>

TABLE 7. TIME DISTRIBUTION OF ACCIDENTS

52% of injuries have occurred during the day time (Table 7).
### TABLE 8. DISTRIBUTION OF SYMPTOMS

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>No. of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>58</td>
<td>95.0</td>
</tr>
<tr>
<td>Mouth open</td>
<td>40</td>
<td>65.6</td>
</tr>
<tr>
<td>Loss of sensation</td>
<td>26</td>
<td>42.6</td>
</tr>
<tr>
<td>ENT bleeding</td>
<td>16</td>
<td>26.2</td>
</tr>
<tr>
<td>Wounds</td>
<td>12</td>
<td>19.7</td>
</tr>
<tr>
<td>Teeth bite</td>
<td>11</td>
<td>18.0</td>
</tr>
<tr>
<td>Unable to open eye</td>
<td>7</td>
<td>11.5</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>8.2</td>
</tr>
</tbody>
</table>

Main symptom was pain in 95% of patients, followed by difficulty to open the mouth (65.6%). Loss of sensation in infraorbital region (42.6%), was the next common symptom (Table 8) (Fig. 22).

![FIGURE 22. DISTRIBUTION OF SYMPTOMS](image)
TABLE 9. DISTRIBUTION OF SIGNS

<table>
<thead>
<tr>
<th>Signs</th>
<th>No. of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step I/O, Zygoma</td>
<td>40</td>
<td>65.5%</td>
</tr>
<tr>
<td>Trismus</td>
<td>39</td>
<td>63.9%</td>
</tr>
<tr>
<td>Subconj Echymosis</td>
<td>35</td>
<td>57.4%</td>
</tr>
<tr>
<td>Malar Flattening</td>
<td>32</td>
<td>52.5%</td>
</tr>
<tr>
<td>Periorbital edema</td>
<td>19</td>
<td>31.2%</td>
</tr>
<tr>
<td>I/O Anasthesia</td>
<td>16</td>
<td>26.3%</td>
</tr>
<tr>
<td>Malocclusion</td>
<td>11</td>
<td>18.0%</td>
</tr>
<tr>
<td>Enophthalmas</td>
<td>3</td>
<td>4.9%</td>
</tr>
<tr>
<td>Diplopia</td>
<td>3</td>
<td>4.9%</td>
</tr>
<tr>
<td>Palatal split</td>
<td>2</td>
<td>3.3%</td>
</tr>
<tr>
<td>CSF Rhinorrhoea</td>
<td>1</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

About 40 patients (65.6%) had step in the infraorbital rim, zygomatico frontal suture line and in the zygomatic arch. Trismus was the next common sign (63.9%). Around 50% of them had subconjunctival echymosis and malar flattening (Table 9) (Fig. 23).
<table>
<thead>
<tr>
<th>Type of Fractures</th>
<th>No. of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated Zygoma</td>
<td>30</td>
<td>49.2</td>
</tr>
<tr>
<td>ZMC</td>
<td>16</td>
<td>26.2</td>
</tr>
<tr>
<td>Max Le F II</td>
<td>5</td>
<td>8.2</td>
</tr>
<tr>
<td>Nasal</td>
<td>5</td>
<td>8.2</td>
</tr>
<tr>
<td>Max Le F II/III</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>Dental ALV</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>Max Le F III</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Isolated zygoma fracture was the most, comprising 49.2% of the total cases. Out of these, left zygoma fractures were more than right. Zygomatico maxillary complex fractures followed by 26.2%. Two patients had Le Fort II & III on either side of the face (Table 10) (Fig. 24).

**FIGURE 24. DISTRIBUTION OF TYPE OF FRACTURES**

![Figure 24: Distribution of Type of Fractures](image)
### TABLE 11. DISTRIBUTION OF ASSOCIATED INJURIES

<table>
<thead>
<tr>
<th>Associated injuries</th>
<th>No. of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft tissue injury</td>
<td>6</td>
<td>9.8%</td>
</tr>
<tr>
<td>Neurological Injury</td>
<td>3</td>
<td>4.9%</td>
</tr>
<tr>
<td>Limb injury</td>
<td>2</td>
<td>3.3%</td>
</tr>
<tr>
<td>Eye injury</td>
<td>1</td>
<td>1.6%</td>
</tr>
<tr>
<td>Blunt injury abdomen</td>
<td>1</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

Maximum number of injuries associated with midface fractures in this study were soft tissue injuries (9.8%). They were lacerations, contusion and abrasion injuries. It was followed by neurological injuries (Table 11) (Fig. 25).

![DISTRIBUTION OF ASSOCIATED INJURIES](image)

**Figure 25. DISTRIBUTION OF ASSOCIATED INJURIES**
TABLE 12. MANAGEMENT OPTIONS

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation</td>
<td>21</td>
<td>34.4%</td>
</tr>
<tr>
<td>Elevation + ORIF</td>
<td>18</td>
<td>29.5%</td>
</tr>
<tr>
<td>Refused treatment</td>
<td>8</td>
<td>13.1%</td>
</tr>
<tr>
<td>Elevation + ORIF + MMF</td>
<td>6</td>
<td>9.8%</td>
</tr>
<tr>
<td>Conservative</td>
<td>6</td>
<td>9.8%</td>
</tr>
<tr>
<td>Nasal bone fracture reduction</td>
<td>2</td>
<td>3.2%</td>
</tr>
</tbody>
</table>

Most of the cases were managed by surgery. Out of these, majority were elevation only (34.4%) in 21 cases. This was done in isolated zygoma fracture and ZMC fracture with minimal displacement. Those unstable and communitied fractures were managed with elevation of zygoma plus open reduction of fracture and fixation with plates (ORIF) (29.5%). Plates with two holes to four holes 2 mm size, were selected for fixation of fractures at zygomatico frontal sutures and fixed with 2X 8 mm screws. For fractures at infraorbital rim, four holes to six hole 1.5 mm size plates were selected and fixed with 1.5X 6 mm screws. Only six cases of Le Fort II and III fractures were managed with MMF with ORIF. Out of 61 cases 8 of them refused treatment. 6 patients (9.8%) were managed conservatively, since they all had isolated fracture zygoma and ZMC fracture with only pain during full mouth opening. 2 cases of nasal bone fractures was managed with closed reduction. All elevations were done under Gillies Temporal approach. Zygomaticofrontal fractures were approached by making
incision lateral to eyebrow and fixed with plate and screws. The infraorbital rim fracture and nasozygomatico buttress were approached through subcilliary incision (Table 12) (Fig. 26).

![Graph showing the management options for nasal bone fractures.](image)

**FIGURE 26. MANAGEMENT OPTIONS**

**TABLE 13. DURATION FROM TRAUMA TO SURGERY**

<table>
<thead>
<tr>
<th>Time of Surgery</th>
<th>No. of Cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 7 days</td>
<td>8</td>
<td>17.0%</td>
</tr>
<tr>
<td>7-14 days</td>
<td>26</td>
<td>55.3%</td>
</tr>
<tr>
<td>&gt;14 days</td>
<td>13</td>
<td>27.7%</td>
</tr>
</tbody>
</table>

All our patients were referred from other departments only. These patients were first seen at casualty and were admitted in surgical
wards. They were referred to our department only after ruling out all other injuries like Neurological, Dental and ENT. So most of these patients were seen by us only around the 4th day. They were sent for investigations like X-rays, CT scan and anesthesiologist opinion only after the 4th day. By this time the facial edema would have subsided and they will be posted for surgery. We have managed to do only 8 (17%) cases within the first week of injury. Rest of the 34 cases (72.3%) were managed within two weeks. Only cases which needed cardiologist opinion and those with comorbid factors like diabetes and hypertension were taken up for surgery after three weeks (Table 13) (Fig. 27).

![FIGURE 27. DURATION FROM TRAUMA TO SURGERY](image)
17 cases of isolated zygoma and ZMC fractures were managed under local anasthesia (36.2%). This was done in very cooperative patients and early fractures and fractures with minimal displacement where elevation only was the main treatment. All ZMC fractures and few zygoma fractures were managed under oral ETGA (51.0%). In patients with Le Fort II, III fractures who needed correction of occlusion, we had requested for nasal ETGA (10.6%). In one patient with bilateral comminuted Le Fort fracture intubation was difficult. He was given anasthesia through nasal ETGA under endoscopic guidance (Table 14) (Fig. 28).

### TABLE 14. TYPE OF ANASTHESIA

<table>
<thead>
<tr>
<th>Anesthesia</th>
<th>Number of cases</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerve block</td>
<td>17</td>
<td>36.2%</td>
</tr>
<tr>
<td>O/GA</td>
<td>24</td>
<td>51.0%</td>
</tr>
<tr>
<td>N/GA</td>
<td>6</td>
<td>12.8%</td>
</tr>
</tbody>
</table>
All patients were followed up after the post operative period and reviewed after one month and again after six months. Some of the patients were on regular follow up even for two years. 30 patients (49.2%) were able to get good occlusion, full mouth opening, good malar prominence with symmetry and very minimal scar. The main complaint was persistent infraorbital anesthesia (19.7%). Three patients had a step in infraorbital and zygomatic arch region. Drooping of the nasolabial region and malar flattening were among other complaints. Only one patient had implant site infection which was managed with antibiotics (Table 15) (Fig. 29).
Cases which were referred to our department during each month was noted for seasonal variation of incidence and this showed maximum number of patients during the month of May, November, December and January (Fig. 30).
CASE 1:
A 18 year old female student, with history of RTA sustained facial injury. Diagnosis: Left zygomatico maxillary complex fracture with Le Fort II and III on right and left side respectively. Management: Elevation, ORIF, Adam’s suspension with MMF.
CASE 2:
A 20 year old male labourer with history of RTA sustained facial injury. Diagnosis: Right ZMC fracture. Management: Elevation with ORIF.
CASE 3:
A 23 year old male labourer, with history of RTA sustained facial injury. 
Diagnosis : Left ZMC fracture. Management : Elevation with ORIF.

Pre-Operative

CT Scan

After 1 year
CASE 4:

Pre-Operative

1 Week Post-Operative

After 1 month Post-Operative
CASE 5:

A 35 year old male, with history of RTA sustained facial injury. Diagnosis: Right ZMC fracture. Management : Elevation only done.

Pre-Operative

X-Ray

After 3 months post-operative
Analysis & Discussion
ANALYSIS OF RESULTS AND DISCUSSION

This study was done in Chengalpattu Medical College hospital which is situated very near to the National Highway. There are many nearby villages around our hospital in which the main occupation was labour job and agriculture. Their main mode of transport was government buses and two wheelers. Overall incidence of midfacial fractures were more in men than in women with the ratio of 5:1 in this study. Similarly there were marked male predominence in a study done in Irbis, Jordan and in Njimegan, Netherlands. But contrast results were observed in a study which was done in Innsbreuk, Austria and in Chennai, India where there was higher female incidence. In a study done by Darashingh et al at Aligarh it shows that 88% were males and 12% were females. Road traffic accidents was the common cause of midfacial fracture in this study (62.3%). Similarly Zachariades et al and Van Beek et al, also noted in their study at Greece and Netherlands that road traffic accidents comprised more than half of their patients [17,14].

This was followed by assault which was around 18% and the least cause was fall (11.5%) in this study.

The incidence of RTA was more among male and it was more in the younger age group ranging from 20 to 30 yrs. This was also similar to the
study done at Aligarh by Darashinig et al in 1202 patients. 32.36 %
involved the same age group and 56 % of the cause was RTA followed by
fall. In the male population most of them of them were labourers, farmers
and students. Darashinig et al [61] in their study also reported similar
results. In their 1202 patients 421(35%) were farmers and labourers.
Among women 40 year old age group constituted the majority and assault
was the main cause. Most of them were house wives. This was also similar
to the study done by Darashinig et al which showed 8% of women were
house wives. In contrast, a study by Eggensperger [62] at Central
Switzerland showed 5% women were office workers.

Out of all road traffic accidents only 2 patients were wearing
helmet. There is no study to compare this because in other countries helmet
usage is a must while driving motor bike.

Alcohol consumption was noted in more then 50% of cases which
was the prime reason in causing road traffic accidents, assault and
interpersonal violence in this study. Kontio et al [20] reported that
maximum number of RTA and assault have occurred during weekends
under the influence of alcohol where the violence was extreme with more
severe injuries and more number of associated injuries.
In the types of fractures observed, maximum cases of zygoma fracture were observed in non-alcoholic patients, with a mean of $17\pm2.8$ and nasal bone fractures with a mean of $3.0\pm1.4$. Whereas, maximum cases of severe fractures like zygomatico maxillary complex and Le Fort I/ II/ III were observed in alcoholic patients, with mean cases $11\pm1.4$ and $6.0\pm3.5$ respectively (Table 16).
Two way Anova revealed that there was significant difference (P<0.01) in the frequency of major fractures in alcoholic patients compared to those of non-alcoholic patients, thus confirming the fact that the fractures of severe nature were more in alcoholic patients.

Post-hoc analysis using Student Newman Keuls Test (SNK) test revealed the variations in the frequency of midfacial fractures. Among the midfacial fractures, frequencies of nasal bone and LeFort fractures were significantly less, while those of zygoma were significantly more. ZMC complex fractures occupied a medium rank in its frequency (Table-17A & B).
TABLE 17 B. SNK TEST FOR VARIATION IN FRACTURES IN ALCOHOLIC AND NON ALCOHOLIC PATIENTS

<table>
<thead>
<tr>
<th>Type of Fractures</th>
<th>N</th>
<th>Subset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasal bone</td>
<td>2</td>
<td>2.0000</td>
</tr>
<tr>
<td>LeFort</td>
<td>2</td>
<td>3.5000</td>
</tr>
<tr>
<td>Zygoma Maxillary complex</td>
<td>2</td>
<td>10.0000</td>
</tr>
<tr>
<td>Zygoma</td>
<td>2</td>
<td>15.0000</td>
</tr>
</tbody>
</table>

Means for groups in homogeneous subsets are displayed, based on Type III Sum of Squares.

The error term is Mean Square (Error) = 6.125. (Harmonic Mean Sample Size = 2.000).

Most of the incidence has occurred in the day time and inside the city. More number of cases were noticed in the month of May, November, December and January. The probable reason may be school holidays during the month of May and December end, where more travelling could have occurred. Due to fog in the month of November, December and early January there may be more number of accidents. Harvest time in villages for the farmers and labourers could be the cause for the increased number of cases in January.
When studying the speed of impact, all road traffic accidents are high velocity injuries and the rest like fall and assault are low velocity injuries. In this study there were more high velocity injuries 62.3% than low velocity injuries which was only 37.7%, similar to results of other studies.

In this study major symptoms were pain (95%), difficulty in opening mouth (65.5%), loss of sensation in infra orbital region (42%) and malocclusion in 18% of patients. These symptoms were very severe in patients who sustained Le Fort II, III fracture with ZMC fracture. Nasal bleeding was definitely present in all Le Fort II and III fractures.

Major signs on examination in this study showed step in infraorbital rim and zygoma (65%), trismus (63%), subconjuntival echymosis (57%), flattening of malar region (52%) and malocclusion in 18% of patients. One patient had CSF rhinorrhoea and 2 patients had palatal split. The more severe injuries had correlation with RTA in young bike and pillion riders who did not wear helmet and had consumed alcohol during accidents.

In the two patients who were wearing helmet there was less severe trauma. One of them had only undisplaced fracture of right zygoma with complaints of pain when opening mouth. He was managed conservatively and had good recovery. The other patient had fracture of left zygoma with difficulty in opening mouth. We had done elevation only under local
anesthesia after which he had good recovery. So wearing helmet was associated with less severe injury to facial bones.

In this study more number of fractures were isolated zygoma fractures (49.2%) followed by ZMC fracture (26.2%), nasal and Lefort II were (8.2%) each and the least was Le Fort III (1.6%). Similar result was shown in a study done by Beaumont et al which confirmed maximum fracture in midfacial injuries were ZMC fractures followed by Le Fort and later by dentoalveolar fractures. In a study of faciomaxillary injuries by Darashingh et al isolated zygoma was the commonest fracture (18%). In one study Rezzan and Nezih [63] found zygomatic arch as the most common site of fracture which is also shown in this study.

In this study soft tissue injuries (9.8%) were the most common associated injuries along with midfacial fractures followed by neurological injuries (4.9%). This was also proved in the study done by Darashjngh et al where soft tissue injuries with or without bone involvement was the most common presentation in faciomaxillary injuries.

In this study majority of patients were managed within 4 days to 2 weeks from the day of trauma. In the early management of isolated fractures of zygoma we have done elevation under local anesthesia. Patients were followed up in the postoperative period and after two weeks and then once a month. Most of them had good mouth opening, occlusion,
good malar prominence and cosmetically good results. In isolated zygoma fracture two weeks later we could not do elevation satisfactorily and there was step in the arch and malar flattening could not be corrected perfectly. Though all these patients could open their mouth after six weeks of regular physiotherapy they still had persistent infra orbital anesthesia and pain while opening their mouth.

**Time of Intervention**

Chi-square test revealed that there was statistically significant variation (P<0.01) between early intervention (1-14 days) and late intervention (above 14 days). Early surgical intervention could bring forth good results with less complication, while in late intervention the frequency of complication was higher (Fig. 31).

![Bar chart showing time of intervention](image)

**FIGURE 31. TIME OF INTERVENTION**
In ZMC, Le Fort II & III fractures we have done elevation with open reduction and fixation with plates at atleast two buttress points. In the early management group we could get good reduction and alignment of fracture segments after elevation and open reduction. These patient on follow up showed good results. All our Le Fort II & III patients were managed within one week because these patients were refered earlier as the symptoms were very severe. Among all the patients only one had implant site infection. Results of early management were definitely good even in patients with high velocity injuries after RTA with severe type of fractures.
Conclusion
CONCLUSION

This study shows that the incidence of midfacial fractures were more in males of 20 to 30 years age group than in females who were between 40 to 50 years.

The main cause in men were road traffic accidents and assault in the case of women.

Most of the men were of low socioeconomic group comprising of farmers & labourers whereas the women were all housewives.

There is a strong correlation with alcohol consumption and helmet defaulters with severe midfacial injuries due to road traffic accidents.

There is a significant correlation with increased incidence during some months in a year when there are environmental changes, increased work load and holiday season which could have resulted in more travelling.

When compared to delayed management, early management of midfacial fractures showed better results functionally and aesthetically with less complications.
Bibliography
BIBLIOGRAPHY


Proforma
MODEL PROFORMA

Name / Age / Sex / P.S no / Hosp no / Address / Occupation

Causes : Pedestrian / Bike rider / Pillion rider / Assault / Fall / Sports

H/o consumption of alcohol

Usage of helmet

Site : Highway / Street / Home / Work spot

Time of Accident : Day / Night

Symptoms : Pain / Bleeding from ear, nose, throat / Loss of sensation in I/O region / Facial wounds / Difficulty in opening mouth / Others.

Signs : Diplopia / Periorbital odema / Subconjuntival Hemorrhage / Flattening of malar prominence / Step in I/O rim, zygoma / Loss of I/O sensation / Trismus / Malocclusion / CSF rhinorrhoea / Palatal split.

Bones involved in fracture : Upper dentoalveolar / ZMC / Nasal complex / Le Fort I, II, III.

Associated injuries : Soft tissue / Neuro / Ear, nose, throat / Limbs.

Comorbid Factors : DM / HPT / Epilepsy / Alcohol / Smoker.

Investigations : X-Ray / CT Scan.

Treatment : Conservative / Surgery- Elevation only, Elevation+ ORIF, Elevation+ ORIF+ MMF / Others / Not willing for treatment.

Duration from Trauma to surgery: < 7days / 7 to 14 days / >14days.

Type of Anesthesia : Nerve block / OGA / NGA / Tracheostomy

Complications : Early- Infection, Malocclusion, Bleeding.

Follow up and Results:
Master Chart
<table>
<thead>
<tr>
<th>S NO</th>
<th>PATIENT</th>
<th>OCCUPATION</th>
<th>CAUSE</th>
<th>HELMET</th>
<th>ALCOHOL</th>
<th>SITE</th>
<th>ON</th>
<th>AGEN/NU</th>
<th>DIAGNO</th>
<th>TREAT</th>
<th>DURATION</th>
<th>ANAS</th>
<th>COMPLIC</th>
<th>RESULTS</th>
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<td>NO</td>
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<td>NIGHT</td>
<td>RIZ#</td>
<td>ELE/ORIF</td>
<td>14&lt;DAYS</td>
<td>O/GA</td>
<td>GOOD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>J/M/46</td>
<td>LABOURER</td>
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<td>DAY</td>
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<td>LIZ#</td>
<td>ELE/ORIF</td>
<td>7-14DAYS</td>
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<td>GOOD</td>
<td></td>
<td></td>
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<td>PEDEST</td>
<td>NO</td>
<td>STREET</td>
<td>DAY</td>
<td>STI</td>
<td>ZMC/L/E</td>
<td>EORIF/MMF</td>
<td>7-14DAYS</td>
<td>NGA</td>
<td>GOOD</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>N/M/28</td>
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<td>ASSAULT</td>
<td>YES</td>
<td>HOME</td>
<td>NIGHT</td>
<td>ZMC/R</td>
<td>ELE/ORIF</td>
<td>7-14DAYS</td>
<td>O/GA</td>
<td>GOOD</td>
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<td>6</td>
<td>V/M/31</td>
<td>LABOURER</td>
<td>BR</td>
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