# AETIOLOGY, OCCURENCE AND CLINICAL CHARACTERISTICS OF MAXILLOFACIAL SOFT TISSUE INJURIES TREATED AT A MAJOR TEACHING AND REFERAL HOSPITAL IN NAIROBI

A Thesis Submitted to the University of Nairobi for the partial fulfillment for the award of the Master of Dental surgery degree in Oral and Maxillofacial surgery.

By

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# DECLARATION

I, Edalia K Bernard, hereby declare that this Thesis is my original work and has never been presented for the award of a degree in any other University.

Signed. Best Date 29th SERT. 2010

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#### DEDICATION

1. I dedicate this study to trauma surgeons who strive tirelessly to treat the injured, in environment where little attention is given to this preventable scourge.

2. To my lecturers who inspired my interest in oral and maxillofacial surgery and to my fellow surgery residents who have continued to be of great support and encouragement.

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#### LIST OF ABBREVIATIONS

A & E : Accident an	d Emergency
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- DCA : Data Collection Assistants
- ENT : Ear Nose & Throat
- FAI : Firearm injuries
- IPV : Interpersonal violence
- KNH : Kenyatta National Hospital
- MF : Maxillofacial
- MF-STIs : Maxillofacial soft tissue injuries
- MVA : Motor vehicle accidents
- NOE : Naso-orbital-ethmoidal
- OMF : Oral and Maxillofacial
- PI : Principal investigator
- STI : Soft tissue injuries

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#### ABSTRACT

*Introduction*: Maxillofacial soft tissue injuries (MF-STIs) are often neglected or trivialized compared to fractures, yet these injuries negatively impact both on function and esthetics. There is a psychological aspect associated with the injury secondary to the patient's concern regarding permanent scarring and subsequent facial disfigurement or dysfunction. Hence, cosmetic outcome is the single most important aspect of care to the patient. The aetiology of maxillofacial injuries in general differs from one country to another because of socio-economic, cultural and environmental factors. Interpretation of these surveys based on aetiology is difficult because of the variation in the classification of injuries that are used. Periodic review of epidemiological data on trauma highlights the health burden of such hazards hence the need for baseline information upon which the evaluation of future trends can be done. There is paucity of such data in Kenya.

*Study Objective*: To describe the aetiology, occurrence and the clinical characteristics of MF- STIs and the immediate intervention modalities.

*Material and Method*: The study setting was at the Kenyatta National hospital (KNH) accident and emergency (A&E) department and the Oral and Maxillofacial clinic. This was a descriptive cross-sectional study. All consecutive patients who presented with MF-STIs to the A&E department at the KNH over the study period from 1<sup>st</sup> September 2009 to 30<sup>th</sup> December 2009 were evaluated. A pre-designed questionnaire was completed for all patients with MF-STIs who required the attention of a maxillofacial specialist.

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**Results:** During the 4-month study, 422 patients were attended to for MF injuries. Patients who sustained craniofacial injuries constituted 32.7% of all trauma patients attending the A & E Department among whom 345 (81.7%) had STIs, whereas 77 (18.2%) had facial fractures in isolation and 113 (26.7%) had facial fractures in combination with MF-STIs. The male to female ratio was 3.3:1. Motor vehicle accidents (MVA) were the leading cause of MF-STIs (44.6%) followed by interpersonal violence (IPV) (39.1%). MVA (50.0%) was the leading cause of MF-STIs in the less than 12- year-olds while falls from heights (58.3%) were the leading cause in under 5- year-olds. The most frequent types of MF-STIs were simple lacerations which constituted 40.2%, whereas multiple lacerations constituted 29.2%. Abrasions constituted 20.5% while avulsions constituted 3%. The upper face was the anatomical site that was injured most (27.4%).Tongue injuries constituted 17.6% of all the injuries to special areas. There were no skeletal fractures observed in the under 5- year-olds.

*Conclusions:* MVA and IPV were the principal causes of the MF-STIs which heavily outnumbered MF skeletal fractures. Males were more afflicted than females. Remarkably, lacerations were the commonest types of MF-STIs whereas orthopaedic and head injuries were the more commonly associated systemic injuries. Most wounds treated were uncomplicated and were managed by dental interns and maxillofacial residents.

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#### CHAPTER 1

# INTRODUCTION AND LITERATURE REVIEW

#### 1.1 INTRODUCTION

Trauma is a major health problem associated with considerable morbidity to the affected individuals and imparts huge socioeconomic costs to society <sup>1</sup>. Trauma in the maxillofacial (MF) region accounts for a high incidence and a variety of these injuries are seen at the emergency department either alone or in conjunction with trauma to other systems <sup>1, 3</sup>. Facial injuries in general are commonly caused by interpersonal violence (IPV), motor vehicle accidents (MVA), falls, sporting accidents and other forms of trauma like burns, gunshot injuries, animal bites and industrial accidents. Most studies on MF trauma in Kenya have concentrated on MF skeletal fractures specifically mandibular fractures or the injury patterns in relation to specific causes, particularly MVA .<sup>16, 20, 21, 25, 26</sup> Studies in developed countries, have documented soft tissue injury (STI) evaluating the distribution, type and mechanism of injury in relation to the aetiology.<sup>1, 3, 8, 23, 36, 39</sup>

The etiology of STIs varies from region to region, therefore, reported statistics vary widely <sup>6</sup>. In the United Kingdom (UK), a national survey revealed that assault was then the main cause of MF trauma<sup>8</sup>. Other studies have reported that falls from heights and MVA were the main causes of STIs, although assault remained the main cause of craniofacial fractures <sup>6, 8</sup>. Bolt and Watts (2004)<sup>8</sup>

reported that falls from heights (56%) and assault (16%) were the main causes of STIs seen at their institution in Nottinghamshire, UK.<sup>8</sup> In Malaysia MVA was the main cause of MF trauma.9 Most studies have shown a lower incidence of maxillofacial (MF) fractures among females. Age and sex influence the incidence and aetiology of facial lacerations. Generally, MF trauma predominantly affects young men. <sup>10</sup> Aetiology is a significant determinant of the distribution of facial lacerations<sup>8</sup>. Global trends regarding aetiology are changing in that there is a decrease in MVA related MF injuries. This is due to a combination of factors including improved road conditions, modern motor vehicle safety measures; the introduction of legislations to curb driving when drunk, introduction of lower speed limits, increase in the frequency of car safety inspections and implementation of mandatory wearing of seat belts in most countries <sup>12</sup> .In Kenya there has been concerted effort to enforce mandatory use of safety belts and enforcement of other road safety measures for the last five years. Causes of MF trauma are constantly changing with changes in lifestyle, industrialization, transportation, and legislative measures. As a result, causes of MF injuries differ in various parts of the world. Although MVA is still the main cause for MF injuries in some developing countries, recent data from developed countries have shown IPV to have been the dominant cause <sup>15</sup>.

Multisystemic trauma is common in MF injuries <sup>1,9,16</sup>. More than 50% of patients with MF have concurrent multisystemic trauma requiring multidisciplinary management between emergency physicians and surgical specialists including Ear, Nose and throat (ENT), trauma , plastic, ophthalmology and oral and

maxillofacial surgeons <sup>3, 13</sup>. Shahrokh et al. (2008) <sup>3</sup> in a study on the treatment of facial trauma coverage among level-1 trauma centers of the United States found that all major trauma centers required the support of various trauma specialists for the management of these injuries <sup>3</sup>. Complex STIs may involve multiple special structures like the facial nerve and the parotid gland with resultant immediate and long-term complications that pose a major challenge in the management <sup>21</sup>. Surgical repair like transplantation, grafting and primary meticulous anastomosis may be necessary<sup>21</sup>. Reconstruction of the skeletal injuries alongside repair of STIs is necessary for satisfactory functional and aesthetic results <sup>1</sup>.Notably, the psychological impact of disfigurement on the face can be devastating if the injuries are not properly managed <sup>4</sup>.

#### 1.2. LITERATURE REVIEW

#### Aetiology

Many studies pertaining to the incidence and causes of MF injuries in general have been published. The causes of maxillofacial fractures have changed over the past years. The main causes worldwide are MVAs, IPV, falls, FAIs, industrial accidents, sports-related injuries and civilian warfare.

#### 1.2.1 Interpersonal violence

Recent studies have shown that IPV is the most common cause of maxillofacial fractures in many developed countries <sup>6</sup> ,although MVAs remain the most frequent cause in many developing countries <sup>9, 13, 23</sup>. However, studies done in other developing countries like Kenya <sup>25, 26</sup> as well as Greenland <sup>27</sup> and

Zimbabwe <sup>28</sup>, have shown that some of the highest incidences of MF injuries, have been reported from IPV. Kai Lee et al. (2007) demonstrated that IPV continues to be the main cause of MF injuries in developed countries when compared to MVA <sup>29</sup>. IPV commonly involves young male adults with alcohol being the main associated factor. <sup>1, 6, 12, 29</sup>

#### 1.2.2 Motor Vehicle Accidents (MVA)

The burden of MVA has been on the increase over the last four decades particularly in Kenya. A national survey undertaken found 63,725 road traffic crushes between 1992 and 1996 in Kenya giving an average of 12,745 crashes per year. About 15% of the crushes were fatal (Macharia et al. 1995.)<sup>11</sup>. In Nigeria, Jordan, and Brazil MVAs were found to have been the most frequent cause of MF injuries, particularly fractures .<sup>13, 23</sup> In the United States and England, MVAs remain an important cause of MF injuries, of which a significant proportion are serious <sup>1, 15</sup>. In most developed countries, the pattern is of a reduction in the number of MVAs and an increase in violence and sporting injuries <sup>29</sup>. Generally in urban settings, injuries due to MVAs and IPV occur in association with alcohol consumption and has been associated with an increased risk of serious facial injuries <sup>13, 23, 25, 26, 29</sup>. Like IPV, MVA commonly involves young male adults <sup>1, 2,6,12</sup>.

#### 1.2.3 Human bites and Animal bites

Though appearing to be more innocuous, such injuries are more destructive in terms of tissue loss and are associated with infections such as Hepatitis A, B, C, HIV and tetanus. The human oral flora is different from those of animals and is more virulent. Tissue loss due to avulsive human bite injuries may be a challenge in reconstruction .Koech et al. (2008) <sup>32</sup> in their study found that males were more affected than females and the lower lip was the most affected part of the face. Injuries were found to have been mainly avulsive in nature. <sup>32</sup> However; infection was not a common complication. Apparently the prevalence of such MF- STIs due to human and animal bites is not well documented.

Animal bites mainly cause STIs by crushing, tearing or avulsion. The bites can be found in any location on the face .Injuries may include lacerations and tears of the scalp, cheek or neck. Animal saliva harbors numerous virulent microorganisms. The main concern from such injury is the transmission of infections. Studies by Bolts et al.(2004) <sup>8</sup> showed that animal-related lacerations were most commonly domestic dog-bites, with a peak incidence occurring in children aged less than 10 years. The incidence decreased with increasing age. Almost all (97%) animal-bites of humans in Kenya are inflicted by dogs. <sup>43</sup> Interestingly, in Nigeria, cows and donkeys were found to have been largely responsible for animal bites of humans resulting in MF injury, and the injuries were mainly lacerations and fractures.<sup>30</sup> There are sporadic case reports regarding MF injuries caused by wild animals in Kenya which commonly involve

herdsmen in the rural areas. The exact prevalence of MF injuries due to animal bites is not well documented.

# 1.2.4 Firearm Injuries (FAI)

Civilian firearm wounds to the maxillofacial region can result in devastating functional and aesthetic consequences for patients. These injuries can result from attempted suicide, homicide or accidents. <sup>34</sup> A significant number of the patients die due to such injuries but some can survive with excessive serious facial injuries <sup>34</sup>. Nonfatal FAIs to the head and neck are of particular interest to the maxillofacial surgeon. The circumstances of injury are varied. Zarina et al. (2002) showed that these can be categorized by intent of injury as follows: 51.4% of attempted suicides, 12% of accidental injuries and 14% of assaults.<sup>34</sup> Firearm wounds can either be penetrating, perforating or avulsive. Wounds to the face range from small-caliber recreational gun pellets to full-scale shotgun blasts in which the facial soft tissue is obliterated. Through-and-through gunshot injuries or close-range shotgun wounds to the face often produce associated MF bony injuries <sup>34</sup>.

Odhiambo et al. (2008) <sup>35</sup> in study of the clinical characteristics of FAIs in Kenya found that they were on the increase and affected all age groups, though, largely it was a disease of young male adults in the 3rd and 4th decades of life. Mortality is higher with increasing age, affects male victims more and is more likely in those with abdominal wounds. The lower extremities are the commonest target among the survivors <sup>35</sup>. Hollier et al. (2001) <sup>36</sup> in a four-year case series of

facial gunshot wounds found that majority of the patients who were afflicted by FAI suffered facial fractures (75%), maxillary fracture having been the commonest (41%).There were great vessel injuries (9%) and eyeball injuries <sup>36</sup>. The prevalence of MF-STIs as a result of FAI in Kenya compared to other causes of injury is not well documented.

#### 1.2.5 Falls from Heights

Falls account for most of the injuries in children and the elderly population<sup>40, 41</sup>. The majority of maxillofacial injuries caused by accidental falls are minor cuts, abrasions and bruises and they are a common source of facial injuries sustained by young children <sup>42</sup>. There is a strong clinical impression that a substantial number of maxillofacial injuries ascribed to accidental falls are actually secondary to an assault or occupational accidents<sup>41, 42</sup>.

#### 1.2.6 Sports related injuries

Sports-related facial trauma usually results when direct contact occurs between players or with a piece of equipment including a projectile or contact against a playing surface. These blunt trauma often result in contusions, abrasions and lacerations. The exact frequency of MF- STIs related to sports participation in Kenya is not well documented. Previous reports in some studies elsewhere estimate sports participation to account for 3-29% of all facial injuries <sup>38</sup>. In terms of overall sports-related injury, facial trauma accounts for 11-40% of injuries attended to by medical professionals <sup>38</sup>. Most injuries are reported in males, particularly those aged 10-29 years. <sup>38, 39</sup>. Other causes of facial trauma include

industrial accidents, domestic violence and the abuse of children <sup>18, 22</sup> that may be characterized as IPV.

# 1.3 PATTERN OF OCCURENCE AND CLINICAL CHARACTERISTICS

#### 1.3.1 Soft Tissue Injuries

The common MF- STIs include lacerations, avulsions, crush injuries, contusions (mostly encountered in sports ) and abrasion injuries. Lacerations may be simple, multiple, contused, clean or contaminated. Avulsion injuries may result in loss of tissue. In a study of the relationship between aetiology and distribution of facial lacerations, Bolt and Watts (2004) found that aetiology had a profound influence on the distribution of facial lacerations <sup>8</sup>. The lips were the commonest site of injury, particularly associated with MVA, falls and assaults. Lacerations resulting from blunt trauma followed a general antero-medial distribution with structures such as the forehead, eyebrows and lips commonly affected. Animal-related lacerations varied greatly in distribution in comparison to other aetiology <sup>2, 8</sup> while those resulting from assaults also appeared to follow a different distribution compared to all other aetiologies. The lips, cheeks, eyebrows and forehead were the commonly traumatized sites following assault <sup>8</sup>.

Previous studies of maxillofacial trauma have shown that injuries of the MF region are comparatively less common in children than in adults .Facial trauma in young children has a preponderance of minor injuries such as to the soft tissue and dento-alveolar region, whereas older children tend to sustain more serious

injuries, such as fractures of the facial bones. <sup>42, 20</sup> As age increases, the severity of injuries sustained increases. Overall, the vast majority of injuries in children and adolescents are minor to moderate. Falls and dog-bites account for the majority of injuries in the younger age group but with increasing age, assaults become a major factor and as a result, fracture incidence increases <sup>42</sup>. Young children sustain injuries after falls or accidents at play but as they grow older they play more contact sports and in their teen years tend to become more exposed to interpersonal violence <sup>42</sup>. In Nairobi and other urban areas around the country there are mushrooming high rise residential apartments mostly in the middle and lower class estates. There have been sporadic cases reported of injured children due to falls though the prevalence is not documented. The overall pattern of occurrence of MF- STIs in children is not well documented.

#### 1. 3. 2 Injuries to Special MF areas

Nerve injuries involve mainly the facial nerve which is most susceptible to injury because of its predominant and superficial distribution. Injury to the nerve causes significant cosmetic and functional defects. Repair may involve use of donor grafts harvested from either the sural or greater auricular nerves. Concomitant trigeminal nerve injury has been noted in patients with maxillofacial trauma. Salivary gland injuries are reported to be rare and may include intraoral lacerations of the duct, penetrating or blunt trauma to the gland with fracture .The parotid gland is situated superficially in the cheek and it is vulnerable to any trauma to the face, but more commonly due to penetrating trauma. Blunt parotid

injuries are rare and are not easily diagnosed <sup>21</sup>. The most common site is over the anterior border of the masseter. Sialocoele is a common complication of parotid duct injuries. The lacrimal apparatus is involved in injuries to the medial canthal region. Injuries to the eyeball may include perforation or corneal abrasion. Injuries to the external ears, eyelids, eyebrow may not be severe but defects are aesthetically incapacitating. Injury to the tongue can result in severe haemorhage or massive swelling that can cause airway obstruction.

#### 1.3.3 Associated Skeletal Injuries

Skeletal MF injuries are less common compared to MF-STIs. Akama et al. (2007) in their investigation on the pattern of maxillofacial and associated injuries arising from road traffic accidents found that majority of the casualties (89.6%) had STIs involving the craniofacial region with facial cuts having been the majority (69.2%).<sup>16</sup> However, injuries to the maxillofacial skeleton were generally uncommon (5.1%). <sup>16</sup> A study by Holmgren et al. (2005) showed that the STIs most closely linked with facial fractures in general were lip lacerations, intraoral lacerations , periorbital contusions ,sub-conjunctival hemorrhages and nasal lacerations. Notably, scalp lacerations and contusions were significantly more prevalent in patients found not to have had facial fractures. <sup>18</sup> The incidence of STIs of the tongue, chin, forehead, cheek, ear, eyelid and eyebrow did not correlate significantly with skeletal fractures. <sup>18</sup> Orbital floor injuries result in an isolated fracture or are accompanied by a medial wall fracture. Ocular injury is high, but globe rupture is rare in orbital fractures.<sup>18</sup> The STIs associated with

nasoethmoidal fractures (NOEs) include damage to the medial canthus, lacrimal apparatus or nasofrontal duct. Zygomaticomaxillary complex fractures may be associated with concurrent ocular injuries <sup>22</sup>. Alveolar fracture associated STIs include mucosal lacerations and contusions. Panfacial fractures are usually due to a high-energy mechanism resulting in injury to the upper face, midface and lower face. These may be associated with soft tissue avulsion or crush injuries and deep lacerations <sup>18</sup>.

#### 1.3.4 Other associated injuries

Concurrent systemic injuries are common in MF trauma. Previous studies on maxillofacial and associated injuries in road traffic accidents in Kenya showed that head injury occurred in 15-48% of all reported injuries <sup>16</sup>. Lower facial injuries tend to be associated with the first and second cervical spine injury while the middle and upper facial injuries are associated with lower cervical spine injury. Chest and abdominal-pelvic injuries may occur in association particularly in patients with multiple injuries. <sup>16</sup> High-impact facial fractures which may be associated with severe STIs may often be associated with other body injuries that can be life threatening. Other associated injuries include fractures of the larynx that may result from a high velocity anterior impact to the laryngeal or hypopharyngeal region. Laryngeal fractures can be single or comminuted and are nearly always occult, only declaring themselves when airway patency becomes compromised <sup>15, 24</sup>.

#### 1. 3. 5 Complications associated with MF-STIs

Generally complications associated with MF injuries tend to be more devastating than injury itself. These are commonly associated with skeletal and STIs.<sup>45</sup> These include airway obstruction, haemorhage and infection. Sialocoele and fistula formation are lesions involving particularly the Stensen's duct (parotid duct). Hypoxia is the principal cause of death. This is usually due to a combination of head injury and massive blood aspiration rather than airway obstruction from displaced jaw fractures or STIs. Specific complications include infection, hematoma, poor cosmesis, flap/wound edge necrosis, nasal septum necrosis, retained foreign body, Sialocoele and loss of function, traumatic microstomia, facial palsy, paraesthesia, Frey's syndrome ,fistula formation.<sup>21,22</sup> Hypertrophic scar formation is a significant long-term complication. The main factors responsible include foreign bodies, haematoma formation, crush injury, devitalized necrotic tissue, dead space and operative trauma.

#### 1.4 Immediate management of MF-STIs

Surgical repair of STIs aims at the restoration of function and aesthetics whereas surgical repair of displaced craniofacial fractures centers on restoring the preinjury alignment of the facial skeleton and that is the ultimate goal of management. <sup>22, 31</sup>. Investigations include plain radiographs, CT scanning, magnetic resonance (MRI) imaging which have proven beneficial in assessing traumatic STIs. Arteriography especially in patients in whom extensive hemorrhage occurs with a questionable source, serves as an excellent study to

evaluate and isolate the source of hemorrhage or to exclude major vascular injuries <sup>22</sup>. Treatment of a patient with significant traumatic facial injuries is treated as one with general trauma, as such, advanced trauma life support (ATLS) protocols must strictly be adhered to so as to ensure optimal outcomes. Airway obstruction, if not properly treated or detected, is associated with high mortality. Facial injuries may appear extremely disfiguring, but they are seldom life threatening. Facial lacerations do not necessarily require immediate treatment because of the excellent blood supply. Traumatic facial injuries are managed only after the patient is stabilized <sup>22</sup>.

#### Definitive Treatment

Ideally the repair of facial injuries should be within the first 8 hours of the initial insult. Generally, the facial skeletal deformities are reconstructed first followed by correction of soft tissue problems. Tissues are less vulnerable to infection and the wound healing process is at its optimum during that time. Repair may be postponed for up to 72 hours if the patient is unstable, provided there is antibiotic coverage and the wound is cleansed and dressed. For patients seen late or those who may have extensive soft tissue oedema, haematoma, the crushing type of injury or contused wound edges, delayed wound closure is indicated. Debridement is indicated for necrotic and contaminated wounds. The use of antibiotics is indicated for contaminated wounds, or wounds involving the mucosal lining of the oral cavity or pharynx or perforations. Infection of the face secondary to trauma can become devastating and can cause significant cosmetic

and functional deformities so that a 24-hour prophylactic coverage with antibiotic is usually necessary. <sup>22</sup> An avulsion or loss of soft tissue may create significant deformity which requires reconstruction. Such wounds should not be allowed to heal by secondary granulation tissue, due to excessive scar formation. Placement of skin grafts either full thickness or partial thickness limits tissue deformity. Local or regional flaps can be utilized. <sup>22</sup> Abrasion wounds may require revision of the scar if the dermal layer is involved. Contaminated laceration wounds should be cleansed and closed primarily. In some, a delay of 5- 7 days may be necessary<sup>31</sup>.Management of a transected parotid duct involves transplantation into the oral cavity or end to end anastomosis, or ligation of the proximal duct. Severe facial injuries require consultation with other specialists including ophthalmologists, neurosurgeons, ENT, plastic, and vascular surgeons. <sup>3</sup>

#### 1.5. STATEMENT PROBLEM & JUSTIFICATION

#### 1.5.1 Problem statement

MF- STIs are common in trauma patients yet largely preventable. Soft tissue trauma is overlooked in studies of trauma epidemiology whereas the quality of life may be compromised in patients after facial injuries due to functional disability or *deformity that may lead to social or psychiatric symptoms. Data on the health* burden, surveillance, prevention and intervention strategies, and consequences of MF-STIs in Kenya is inadequate. Thus this study aimed at determining the etiological factors and the pattern of occurrence of MF-STIs presenting at the KNH, and the immediate management intervention provided.

#### 1.5.2 Justification

(1) Periodic review of trauma epidemiological data highlights the medical burden of such health hazards. The value of accurately recording trauma data has obvious implications for improving care by its use in clinical audit, service provision and the planning for human resource requirements along accepted parameters. The data would be utilized for public health approach to injury prevention. In Kenya such data on MF-STIs are inadequately documented.

(2) There is variation in the information from centre to centre regarding the aetiology of MF-STIs thus the information obtained from previous studies in other centres cannot be utilized to predict the occurrence in our set-up. Data obtained in our setup will also be used as a baseline for further evaluation of the future trends of MF-STIs.

(3) The findings of the study should be utilized partly in the formulation of a management protocol for facial injuries presenting at referral centres in the country.

#### 1.6 **OBJECTIVES**

#### 1.6.1 Broad objective

To describe the aetiology, pattern of occurrence and nature of MF-STIs treated at the KNH over four consecutive months.

#### 1.6.2 Specific objectives

- 1. To determine the etiological factors associated with MF-STIs in trauma patients presenting at the Kenyatta National Hospital (KNH).
- 2. To determine the types of MF-STIs in patients presenting at the KNH.
- To determine the types of MF skeletal injuries in patients presenting with MF-STIs at the KNH.
- 4. To identify the immediate treatment modalities for MF-STIs at KNH.
- 5. To identify the immediate systemic complications associated with MF-STIs

#### 1.7 STUDY VARIABLES

(i) Sociodemographic data including age, gender and residence

#### (ii) Dependent variables

1. Types of STIs: – Superficial lacerations (involving the skin only), deep lacerations (involving deeper structures beyond the subcutaneous tissue), abrasions, avulsion, contusions and perforations

2. The anatomical site of facial injuries, intra-oral ,extra-oral involving the upper facial 1/3, the middle 1/3, the lips, cheeks, nose.

3. Involvement of special structures including:- nerve injury, major arteries, salivary glands, lacrimal gland, lacrimal duct, salivary gland duct, ears, eyeball, tongue, upper and lower lips

4. The associated general skeletal injuries including mandibular fracturescondyle, body, ramus, symphysis; isolated midfacial fractures, complex midfacial fractures, upper facial fractures Complications:- airway obstruction, bleeding, sialocoele, infection, mortality,
 Other associated injuries:-head injury, abdominal injury, chest injury, other skeletal injuries

6. The immediate treatment such as primary suture, surgical toilet and primary closure, surgical toilet and delayed closure, grafting, repair

7. Emergency treatment: - tracheostomy, intubations, blood transfusion

8. Cadre of the attendant person:- surgeon, general doctor, nurse

9. Hospital admission

(iii) Independent variables : based on the aetiology:-

- MVA
- IPV
- sports injuries
- fall from a height
- others

#### **CHAPTER 2**

#### MATERIAL AND METHOD

#### 2.1 Study area

The study was conducted at the KNH-A&E department, the oral and maxillofacial clinic at the dental department and other surgical consultation clinics that handle trauma. KNH is the largest national referral and teaching hospital in the country and is located in the city of Nairobi. The hospital has a bed capacity of 1200 and receives referrals for specialized treatment and emergencies. Both the clinic and the A&E department at the KNH are busy referral centres and handle cases from all over the country. Though KNH is a tertiary referral facility in the capital city the catchment area encompasses the city, several towns and rural areas thereby providing a sample that reflects the general trend in the population.

#### 2.2 Study population

The study included all patients seen at the KNH who presented with MF injuries between September 2009 and December 2009 and were treated at the surgical referral clinics, the A & E department.

#### 2.3 Sampling method

A consecutive non-probability sampling method was used. The sample included all consecutive patients who presented with MF-STIs and with or without associated skeletal maxillofacial injuries.

#### 2.4 Sample size

This was based on the number of patients who presented to the KNH and had suffered MF injuries either in isolation or as part of multiple injuries. From the previous records, about 15,000 trauma patients are seen annually at the KNH. The proportion of CMF injuries seen at KNH annually is about 13.6. % (2050 patients). The formula for prevalence studies (Corlien et al. 2003)<sup>44</sup> :-

 $n = Z^2 P (1-P) / d^2$ 

n= desired sample size when n > 10,000

Z = standard error corresponding to 95% confidence level

d = degree of accuracy

P = proportion of target population estimated to have maxillofacial injuries. \*In the current study the proportion was estimated to be about 13.6%. Therefore  $n = Z^2 P (1-P)/d^2$  1.96<sup>2 ×</sup> 0.136 (0.865) / 0. 05<sup>2</sup> = 180.6 The estimated minimum sample size was 181 patients, however, 422 patients were evaluated.

# 2.5 Inclusion criteria

- All trauma patients with facial injuries presenting at the A & E who consented were recruited into the study.
- Trauma patients with other injuries being reviewed for facial injuries
- Patients within all age groups with MF injuries
- Consultations for admitted patients with MF injuries

#### 2.6 Exclusion criteria

- Isolated scalp injuries or isolated ear and eye injuries
- Facial burns (usually managed by Plastic surgery burns specialists)
- Patients not willing to participate in the study
- Unaccompanied comatose patients
- Referrals whom some treatment had been done

#### 2.7 Study Design

The study was a hospital-based cross-sectional study. This was an explorative study to give an impetus into the profile of craniofacial injuries through a survey in our population. The survey took place over four month period between 1<sup>st</sup> September 2009 and 30<sup>th</sup> December 2009.

#### 2.8 Data collection

Data were obtained through interviews, clinical examination and evaluation of the imaging investigations of the individual patient. Pre-designed data collection forms were used. File numbers (but not names) were recorded for ease of verification. The data collection assistants (DCA) had basic knowledge of MF injuries, and were trained prior to the commencement of the study to ensure internal validity of the data. Prior calibration of the Principal Investigator (PI) (self) and the DCAs was done to minimize the inter-examiner and intra-examiner variation in data collection. The Cohen Kappa score from the gold standard was 0.92, where n=10 (for the PI). For the DCAs the scores were 0.89, 0.90, 0.80, 0.92, and 0.88 for DCAs 1, 2, 3, 4, and 5 respectively, where n=10. The predesigned proforma was piloted at the KNH A & E department. After this successful pilot study, the proforma was modified and printed in numbered pads of eight pages. Patients or guardians were interviewed to obtain the relevant information. MF–STIs were recorded based on clinical examination. The distribution of craniofacial injuries within the facial anatomy was recorded using the MCFONTZL system developed by Lee et al <sup>5</sup>. with modifications where appropriate.



Fig 2. 1. illustrating the MCFONTZL system of recording the distribution of facial STIs

**Key :** Modified MCFONTZL classification of soft-tissue injury.(acronym for F: forehead; O: orbit; C: chin;N: nose; L: lip (upper and lower); E: ear; Z: zygoma.)

### 2.9 Data Processing

The information in the data capture chart was coded and analyzed using the Statistical Package for Social Sciences (SPSS) version 13.0 for Windows with the assistance of a statistician. A database was constructed on Microsoft Access for entering the proformas. Analysis of the pattern of occurrence of soft tissue

and skeletal injuries was done to establish the aetiology, clinical presentation, management and complications. The Chi square and the Student's t-test statistical procedures were used. Statistical testing was considered significant only when a p value of < 0.05.

#### 2.10 Study challenges

- Most injuries were brought in at night
- Mass accidents or occasional civil disorders encountered during the study period would change the incidence of MF injuries.

2.11 Competing interests: None.

#### 2.12 Funding

This work was supported by a grant from my employer and personal contribution. The sponsors had neither influence on the study design, analysis nor interpretation of the data, nor upon the writing of the manuscript and submitting it for examination.

# 2.13 Ethical Considerations

The study protocol was approved by the Kenyatta National Hospital and the University of Nairobi Ethics and Research committee (Annex E) based on the ethical considerations that were explained to the patients in the consent form (appendix C and D).

#### CHAPTER 3

#### RESULTS

During the 4-month study, 1,289 patients presented with diverse injuries among whom 422 (32.7%) were attended to for MF injuries. Among patients with MF injuries, 345 (81.7%) had facial STIs whereas 77 (18.2%) had facial fractures in isolation and 113 (26.7%) had facial fractures in combination with STIs. Generally, of all the patients with facial trauma there were 98 (23.2%) females while males comprised of 324 (76.8%), giving a male to female ratio of **3.3**: **1**. The mean age for patients who sustained STIs in general was 29.5 years (range of 2 to 88 years) while the average was **30.98** years for men and **25.32** years for women. The average number of facial injuries per month was 109.5 (range of 96-141). The minor category of facial STIs comprised of **10.6%** (n=136) of all the trauma cases (1,289) in general. No surgical treatment was required in the minor category.

Men represented the majority (74.5%) of patients attended to with facial injuries (n=345). The gender distribution across age groups is illustrated in Figure 1.3. The average age for male patients with MF-STIs was 30.98 yrs (SD 11.68) while for females was 25.32 yrs (SD 11.58). *The difference between the mean age for males and females was statistically significant* (p<0.005 t=3.865, df=327). Males had a statistically significantly higher mean age than females.



Fig 1.3. Distribution of the patients with MF-STIs according to the age groups.

The variations in the frequency among the age categories according to gender was statistically significant (Pearson's  $X^2 = 19.457 p \le 0.05$ . df=7) (Fig. 1.3) Children below the age of 12 years constituted 9.1% of all the cases of MF- STIs (*n=28*). Remarkably 50% of these injuries were caused mainly by MVA, followed by falls from heights (35.7%).Table 1.3 summarizes the causes of MF-STIs among children below 12 years.

Causes of injuries	Responses	
	Ν	Percent
Motor vehicle accidents	14	50.0%
Interpersonal violence	4	14.3%
Fall from height	10	35.7%
Total	28	100.0%

Table 1.3. Causes of CMF-STIs among children below 12 years.

Regarding children below 5 years of age (n= 13) the leading causes of MF-STIs were falls from heights (58.3%) and MVAs (33.3%).IPV as a cause of injury in this age category was not remarkable. For the children less than 5 years of age the ratio of males to females was 1:1. The highest proportion of injuries was in the 19-25–year-old and 26-35-year-old age categories.IPVs and MVAs were the leading causes of injury in the 26-35-year-old age category (Fig. 2.3).


Fig. 2.3. Pattern of occurrence of MF-STIs among the age groups according to the aetiological factors.

Generally the majority of facial injuries 52.9 % occurred at the weekend (Fig. 3.3). Regarding the period of the day, majority of the injuries occurred during the day (40.9%) while 32.5% occurred at night. The variation in the frequencies of occurrence based on the day of the week was Statistically significant. ( $\chi^2 = 9.301, df = 6 p < 0.005, n = 345$ ).



#### Fig 3.3. pattern of presentation injuries according to the day of the week.

However, the occurrence appeared to have been dependent on the associated etiology. Most of the IPV-related injuries (*n=135*) occurred at night (53.6%), compared to day time (31.9%). The variation in the frequency according to the period of the day when injury due to IPV occurred was statistically significant (at p<0.05,  $X^2 = 12.0583$ , df=1). Most of the MVA-related MF injuries (62.45%) occurred during day time (*n*=154). The difference in the proportions of the occurrence of MVAs depending on the period of the day was statistically significant (p<0.005,  $X^2 = 5.407$  df=1).

Table 2.3. Pattern of MF-STIs according to the aetiology.

			_
	responses	proportion	
Causes of injuries		%	
IPV	135	39.1%	m.inte
MVA	154	44.6%	
Fall from height	35	10.1%	
Firearm injuries	7	2.1%	
Human Bites	11	3.2%	
Animal bites	2	0.6%	
Sports injuries	1	0.3%	
	345	100%	
× 4			

MVA was the most frequent etiological factor of MF-STIs (44.6%) followed by IPV (39.1%). The most frequent aetiological factor associated with MF injuries among men was IPV 42.8% whereas MVA (54.3%) was the most frequent cause involving women. **Table 2.3** summarizes the distribution of injuries according to the associated etiological factors.

A significant degree of gender variation existed in the sample regarding distribution of the proportions depending on the aetiology. A general male tendency was seen in all injuries in general **(Table 3.3)** *Particular male bias was evident in injury resulting from IPV and FAI. MVA caused injury in a higher proportion of females, whereas in males both IPV and MVA caused injury in significant proportions. There was no gender bias regarding injury due to human* 

bites (Table 3.3). The differences in the frequencies between males and females was statistically significant for IPV and MVA (p<0.05) (Table 3.3).

Table 3.3. Distribution of male and female injury cases according to the etiological factors (n=345).

		an a chann a na an a	Chi value X <sup>2</sup>	df=1
	MALE	FEMALE	p<0.05	
MVA	106	48	1.897	
IPV	107	28	7.188	
Fall from height	28	7	0.392	
Human Bites	6	5	2.538	
Firearm injuries	7	-	-	
Animal bites	2	-	0.671	
Sports injuries	1		-	

Among the patients who sustained injuries arising from MVA,(*n*=154) the majority of were passengers ( 49.03%), while pedestrians constituted 34.8% of the patients and motor cyclists constituted 16.1%. There were more men than women in the group of MVA involving passengers (63.2%), pedestrians (75.9%), and motorcycles (88%). The variation in the frequencies of the male and female injured due to MVA involving passengers was statistically significant.

The variation in the frequency of the male and female injured due to motorcycle accidents and MVA involving pedestrians was not statistically significant.



Fig 4.3. Distribution of the MF-STIs among different age groups according to the etiological factors.

Generally, the MVA-related injuries (*n*=154) were most frequent in the 13 to 25year-old age group (34.2 %) and the 26-35-year-olds (40.2%), whereas the least number of injuries was recorded in the age of over 55 years (1.3 %). The differences in the proportion among the age categories depending on the type of MVA were statistically significant for the MVA involving pedestrians ( $X^2$ = 11.706), MVA involving passengers ( $X^2$ = 4.768) and motorcycle accidents ( $X^2$ = 4.6) respectively (*p*-level < 0.05, *df*=6) Fig. 4.3 summarizes the distribution of cases in different age groups according to the type of MVAs. Table 4.3. Distribution of the occurrence of various forms of IPV among the Malesand Females.

	Female	Male	Total
IPV non domestic	17	103	120
Domestic	10	3	13
Child abuse	1	1	2
Total	28	107	135

Generally, IPV caused 38.7% of all the MF-STIs compared to MVA at 44.4% (Table 2.3) .The number of injuries due to IPV was highest proportionately in men (42.8%) compared to women (26%) (*Table 4.3*). However, both IPV (42.8%) and MVA (42.45%) caused a larger percentage of injuries in men (n=.257). A greater percentage of IPV-related injuries in females (72.7%) were injured as a result of domestic IPV compared to men (2.8%) (*Table 4.3*) . *The difference in the proportions of males and females injured due to domestic IPV was statistically significant* (*Pearson's*  $X^2 = 13.805$   $p \le 0.05$  df=1). However, most of the IPV related injuries in men (88.5%) were as a result of non-domestic IPV(*table 4.3*). *The difference in the proportions of males statistically significant* (*Pearson's*  $X^2 = 18.442$   $p \le 0.05$  df=1) (Table 4.3).

Regarding the place of injury the street was the more likely location at which MF-STIs due to IPV occurred (66.3%), followed by home (17.3%). Entertainment spots were the least likely places for IPV (5%). (Fig 5.3). This distribution was repeated for IPV on males and females when they were examined separately.



Fig 5.3. Proportions of the places where injuries due to IPV occurred (n=135).

The variation in the percentages according to the place of injury as a result of IPV was statistically significant among the study group (Pearson's chi test p< 0.005 df=4) (Fig 5.3).

Implements commonly used were knives (42.5%) whence other crude modes of assault like fists, kicks and blows featured significantly (42.5%) in causing craniofacial STI.



Fig 6.3. Types of weapons used in IPV (n=108).

Regarding age, gender and occurrence of IPV, generally, the 26-35 – year-old category suffered the greatest numbers of injuries due to IPV (45.7%) followed by the 13-25-year old (20.9%) and the 36-45-year-old age groups (17.8%) *(n=135)*. The over 55-year-old and the less than 12-year-old were the least affected .IPV was a rare cause of facial injury at the extremes of life (Fig 7.3).

The differences among the age groups in the percentages of the forms of IPV resulting in maxillofacial injury was statistically significant among males and females (Pearson's  $X^2 = 13.699$  for the males and  $X^2 = 4.260$  for the females , p < 0.05, df = 5).



*Figure 7.3. Distribution of injury cases arising from IPV according to gender and age groups.* 

Regarding the association of IPV with alcohol at least 14.1% (n=19) of IPV cases (n=135) were related to alcohol consumption. Generally, the individuals in the 26-35-year-old age group had the highest proportion of injuries associated with alcohol consumption (44.4%). There were no recorded cases of injuries due to IPV with a history of alcohol in the less than 12-year-old and more than 45-year-old age brackets (Table 5.3).

Table 5.3: Distribution of Injuries due to IPV associated with alcohol consumption across the age groups based on gender (n=19).

Age range	< 12	13-25yrs	26-35yrs	36-45yrs	TOTAL
	- 	. *		-	
Female	0	0	16.7%	-	16.7%
Male	0	22.2 %	27.8%	33.3%	83.3%

Of all the cases of injuries related to alcohol, 61.3% were as a result of IPV. Alcohol consumption conveyed an increased risk of MF injury due to IPV. The variation in the proportion of alcohol related injuries among the males and females according to the age groups was statistically significant ( $X^2 = 10.950$ ,  $p \le 0.05$ ,) The ratio of males to females who sustained injuries as a result of IPV in association with alcohol was 5:1 which was comparable to that of MVA in association with alcohol (5:1). The 26-35 –year-old age group experienced the

greatest proportion (56.7%) of alcohol-related MF-STIs, followed by the 36-46year-old age group (23.3%). The 46-55- year-old age groups and extremes of age, the under 12-years and over 55-years age categories had no incidences of alcohol-related injuries (Table 5.3). Generally males constituted 83.3% of all the alcohol related injuries regardless of aetiology while females constituted 16.7%.

Table 6.3.	proportion of	MF-STIs for each aetiology in association with alcoho	)
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Causes of injuries	History of Alcohol usage within 24hrs before injury	Chi value, $X^2$ at df=1, p < 0.05
IPV .	19 (61.3%)	6.069
MVA	7 (22.6%)	7.395
Fall from height	2 (6.5%)	0.587
Human bites	3 (9.7%)	4.373
Total	31 (100%)	

Of the aetiologies that were positive for alcohol consumption within 24 hours before injury, IPV had the highest proportion (61.3%) followed by MVA(*Table 6.3*).

The mean age of those affected by falls was 26 years .Notably, these were the commonest cause of injury among children less than 12 years of age and

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constituted 10.4% ( total n=35) of all MF injuries. A bimodal distribution was notable at the age groups 13-25 and 36-45 years (Fig. 8.3). The variation of the frequencies of the occurrence among the age categories was statistically significant ( $X^2$ = 18.046,df=4 for the females and for the males  $X^2$  = 13.155,df=5 at p< 0.05) (Fig 8.3).

Table7.3. Distribution of injuries due to falls across gender and age groups.

	Ger	Total	
Age of respondent	Female	Male	
Less than 5 years	4	3	7
6 - 12 years	1	2	3
13 - 18 years	1	0	1
19 - 25 years	1	5	6
26 - 35 years	0	7	7
36 - 45 years	0	8	8
46 - 55 years	0	2	2

There was no statistically significant difference in the frequencies between the male and female patients who sustained MF-STIs as a result of falls from heights. (Pearson's  $X^2 = 0.392$ , p< 0.05 df=1) (Table 7.3).



Fig 8.3. Frequencies of facial STIs arising from falls from heights according to the age groups.

The variation in the frequencies among the age groups for the patients who sustained injuries as a result of falls from heights was statistically significant (Pearson's  $X^2 = 14.340$ , p<0.05, df=1) (Fig 8.3).

During the study period 11 (3.2% of all MF injuries) patients with facial injuries caused by human bites presented for treatment among whom 6 were male and 5 female. During the period of study only one case of craniofacial injuries due to sports was recorded.





There were no recorded cases of human bites among the below 18 years and above 45 years of age categories (*Fig* 9.3). *The differences in the proportions in the age categories is statistically significant among the females* ( $X^2 = 2.262$ , df =4) and among the males ( $X^2 = 2.395$ , df=5 p<0.05).

There were only two cases of animal bites recorded during the study period. One was due to a dog- bite while the other was due to a donkey- bite.

There were 52 cases of FAI treated at the A&E, among whom seven sustained maxillofacial injury. Six of the patients reported having been shot by thugs. Only one peculiar case was recorded of a14-year-old boy who had sustained FAI as result of shooting by cattle rustlers.

# Types of MF-STIs

The commonest type of STI was lacerations. Crush injuries were remarkably rare. Fig. 10.3 summarizes the types of injuries treated at the A&E department.



Fig 10.3. Distribution of the various types of MF-Soft tissue injuries according to clinical charecteristics (n= 522 observations).

Anatomical distribution of MF-STIs





#### Neck 0.6%

# Fig 11.3. Summary of the distributions of MF-STIs according to facial anatomical sites.

The most common sites to sustain lacerations were the forehead (27.4%), the chin (26.2%), eyebrow (4.9%), midface (16.3%) upper lip(12.7%) and lower lip (12.3%). Nasal (2.4%), eyebrow (7%) ,ear (1.9%) and Scalp injuries(5.4%) were less frequent. Panfacial soft tissue injury constituted 3.6%.Neck injury was much more less frequent (0.65%) (Fig. 11.3). The distribution of the specific types of injuries followed the same pattern as the distribution of injuries in general. There were more lacerations, contusions and abrasion injuries in the upper face than the mid-face, and a similar pattern was observed for all the specific injury types.

In the less than 5-years-old age category the most frequent MF-STIs were simple lacerations which constituted 71.4% and abrasions (28.6%). The lower face was the anatomical site that was injured most (23.5%). Surprisingly, unlike in adults, the upper face was the least injured (5.9%). Dentoalveolar fractures constituted 23.5% of all the injuries in this age category. Occurrence of tongue injuries was significant (17.6%). There were no skeletal fractures recorded in this age group whether in isolation or in association with MF-STIs.

Table 8.3. Occurrence of soft tissue injuries and the proportion of their frequencyaccording to the respective aetiology.

Causes of injuries with n = number of observations					
Types of Soft Tissue	Motor vehicle	Interpersonal	Fall from	Human	
mjuries	accidents	violence	height	bites	
Simple lacerations	<b>45</b> (32.8%)	<b>42</b> (47.7%)	13 (50%)	<b>0</b> (0%)	
		/>			
Multiple lacerations	48 (35.0%)	<b>22</b> (25%)	5 (19.2%)	<b>2</b> (33.3%)	
Abrasions	20(2120/)	17 (10, 3%)	7 (26 0%)	0 (0%)	
ADIASIONS	29 (21.270)	17 (19.576)	1 (20.970)	0 (0 /8)	
Avulsions	10 (7.3%)	2 (2.2%)	0 (0%)	2 ( 3.3%)	
Perforations	4 (2.9%)	3 (3.4%)	0 (0%)	0 (0%)	
Crush injuries	1 (0.73%)	<b>2</b> (2.2%)	1 (3.8%)	<b>2</b> (33.3%)	
			·		
Total	(100%)	(100%)	(100%)	(100%)	

# (Where n= number of observations)

The difference in the frequencies of the types of soft tissue injuries according to the aetiology was statistically significant ( $X^2 = 68.45 \text{ df} = 18 \text{ (p > 0.05)}$ .

Regarding the anatomical distribution of the injuries of the craniofacial region based on the etiology, STIs resulting from MVA and falls from heights followed a similar pattern as IPV injuries. IPV (non-domestic) was the leading cause of upper facial injuries (15.5%) followed by MVA-passenger (11%), likewise IPV(non- domestic) for midface (10%) followed by MVA-passenger (5.8%) and the lower face (9.2%). Panfacial injuries were commonly caused by non-domestic IPV (3.8%).Dentoalveolar (12%) and tongue (24%) injuries were commonly caused by IPV.

Of the 345 patients with MF-STIs about half of the total number (152) sustained intraoral injuries. Dentoalveolar sites constituted 24% of all the injuries followed by mucosal injuries at 21.4% while tongue injuries constituted 6.7%. Injury to the submandibular gland was less frequent (0.4%) as well as the parotid gland (0.9%).Eyeball injuries constituted 5.7%. Injuries to blood vessels constituted 8.7% while those of nerves were 5.2% of all the injuries to special areas.



MVA



**HUMAN BITE** 



IPV



**DOG BITE** 



FAI



Data with regard to associated skeletal injuries demonstrated that 32.8% (*n*=113) of the patients with MF-STIs (*n*=345) had associated MF skeletal fractures among whom 50.4 % were mandibular fractures. The occurrence of associated skeletal fractures is summarized in Table 9.3.

 Table 9.3. Comparison between the pattern occurrence of facial skeletal injuries

 associated with MF-STIs and those without STIs.

	Responses				
	Skeletal fractures	Skeletal fractures without			
	In association with	STI			
51 S	STI				
Mandibular fractures	57	36			
Zygomatic	25	21			
Nasal	12	8			
Maxillary	12	12			
Panfacial fractures	5	-			
NOE	2	-			
	ж, »				
Total	113	77			

The proportion of the occurrence of mandibular fractures was similar regardless of whether STIs were involved. Regarding Skeletal Injuries occurring without STIs the male : female ratio was found to have been 6.6:1.

	Overall N= 345	MF STI	Isolated MF skeletal trauma n= 77
	2 2		
MVA	154	(44.6%)	34 (44.1%)
IPV	. 135	(39.1%)	37 (48.1%)
Falls from height	35	(10.1%)	5 (6.5%)
Human bites	11	(3.2 %)	-
Animal bites	2	(0.6%)	-
FAI	7	(2.1%)	1 (1.3%)
Sports	1	(0.3%)	-
Total	345	(100%)	77 (100%)

Table 10.3. Comparison between the aetiology of maxillofacial skeletal trauma and overall occurrence maxillofacial soft-tissue injuries without skeletal trauma.

The leading cause of MF skeletal fractures occurring without soft tissue injury was IPV (48.1%). Table **10.3** summarizes the comparison between the aetiology of MF skeletal injuries and that of MF-STIs. Non-domestic IPV (40.6%) was leading cause among those injured due to IPV (n=37) in general. **Fig 13.3** illustrates the pattern of the causes of MF-STI compared with the causes of MF-skeletal Injuries in general.



Fig 13.3. Pattern of the causes of skeletal fractures in general compared with the causes of STIs by proportion (n=345 for STIs and n=77 for MF Skeletal fractures without STIs).

Regarding MF skeletal fractures without MF-STIs females (n=13) sustained fractures predominantly from MVA (71.4%) whereas males (n= 64) sustained fractures mainly from non-domestic IPV (44.3%) of all males with fractures. Domestic IPV comprised of 28.6% of all the fractures sustained among females. MVA–related skeletal fractures among males constituted 19.7% of all the males.

The age groups most afflicted were those between 13-25 years, (males 87%) and 26-35 years (females 89.7%). The differences in the proportions among the male and female depending on age category was statistically significan ( $X^2$  = 3.478 p < 0.001 df=6).

# Associated systemic injuries

Orthopedic injuries (38.8%) were the most common concurrent systemic injuries followed by head (30.5%) ,chest (9.7%) and ophthalmological (9.7%) injuries. Others such as abdominal (5.8%) and cervical spine (0.7%) injuries occurred less commonly regardless of the cause of injury (Table 11.3).

Table 11.3.	Pattern of systemic injuries associated with	MF-STIs according to the
etiological i	factor.	

	Causes of injuries				
Other associated	Motor vehicle	Interpersonal	Fall from	Human bites	
	accidents	violence	height		
Head Injury	24	14	3	0	41
Chest Injury	8	5	0	0	13
Abdominal/Pelvic injury	7	1	. 0	0	8
Long bone fractures	33	17	1	· 1	52
c-spine#	0	1	0	0	1
Skull #	3	3	0	0	6
Injuries of the eyeball	7	5	1	0	13

The differences between the causes of injury in the frequencies of systemic injuries associated with STIs was statistically significant ( $X^2 = 123.5 \ p \le 0.05$  df=18).

### Immediate management of the MF-STIs.

Out of the 345 patients presenting with MF-STIs there were 522 different types of injury wounds observed that required immediate treatment. Primary suturing was the main method of repair used. Where suturing was required, various clinicians carried out the majority of treatment (82.9%). Most of the immediate treatment was undertaken by maxillofacial surgery residents (29%) and dental interns (53.4%). About 6.2% of the patients were treated by general surgeons whereas nurses treated 10.7%. Up to 68.8% only required simple closure, whereas 31.1% required closure in layers whence 92.9% of the repairs were done in the first 24 hours of injury. A small fraction (2.45%) was managed after 36hours. Another 2.4% were repaired 72hours after injury. Referrals from peripheral facilities constituted **19** %. The majority of the patients were from Nairobi and the surrounding areas. About 50.7% of the respondents were given antibiotics upon treatment and 38.6% were given tetanus toxoid.

Further stabilization of fractures (displaced and undisplaced) was undertaken as secondary procedures. Only 0.9% had immediate open reduction and internal fixation of the fractures. About 10.1 % of the patients with MF-STIs were admitted to hospital among whom 8% were females, whereas 92% were men.

The most widely utilized imaging modality was plain radiography (66.9%), followed by CT scans (32.6%).MRI was utilized for only one patient. Ultrasound and angiography were not utilized at all. A total of 239 imaging investigations were utilized.

Table	12.3.	Pattern	of	emergency	operations	among	patients	with	MF-	STIs.	

Reason for emergency Surgery		Responses
	n	Percent
Surgical toilet	8	29.6%
Control haemorrhage	10	37.0%
Immediate reconstruction	2	7.4%
Multidisciplinary intervention	7	25.2%
Total	27	100.0%

While a few patients with MF-STIs (6.3%) underwent unplanned operations immediately, mainly to control haemorhage (37.0%) and 29.6% were for surgical toilet, 25.2% of them underwent emergency surgery to the maxillofacial area as part of a multidisciplinary intervention. Only 7.4% underwent immediate reconstruction, one injured as a result of human bites and the other as a result of MVA. During the period of the study three patients suffered multiple life threatening injuries leading to mortality (0.7%).

Regarding emergency intervention in patients with MF-STIs Intubations were required in 53.8% of all the emergency procedures, whereas chest tube insertion was done in 15.3%. The chest tubes were inserted in two patients with MF-STIs both of whom had been injured as a result of MVA .Blood transfusion was done in 30.7% of the cases who had been injured as a result of MVA while one was as a result of IPV.The most frequently consulted doctors for multiply injured patients with craniofacial injuries were the ophthalmologists 24%, neurosurgeons (20%), orthopaedic surgeons (16.5%) , ENT surgeons (11.9%). There were a total of **236** consultations during the period of the study.

#### CHAPTER 4

#### DISCUSSION

While most previous similar studies have concentrated on facial bone fractures, this study emphasized on MF-STIs. There have been few studies on STI in the maxillofacial or craniofacial region in Kenya. In this study, the principal causes of MF-STIs were MVAs, IPVs and falls from heights. Human bites and FAIs were minimal, but the injuries were so devastating. MVAs were the commonest cause of the MF-STIs with majority of the affected individuals having been passengers and pedestrians. The burden of MVA has been on the increase in Kenya over the last four decades.<sup>11</sup> This is in contrast with the developed countries, where the pattern is that of a reduction in the number of MVA and an increase in interpersonal violence and sports injuries. <sup>6, 8, 9</sup> Motorcycle-related injuries were the least among the categories of MVAs. Perhaps majority of the city dwellers use motor vehicles frequently and do not use motorcycles more often. However, MVA involving motorcycle may have a higher frequency in the rural areas where there has been considerable increase in the number of motorcycles owing to the readily affordable cheap motorcycles from the Far East.

In this survey, young adults (26-35 years) were at the highest risk of MF injury due MVA. Almost half of the MF-STIs due to MVA were passengers. A previous local study done in a populous town in western Kenya indicated pedestrians as the majority of those injured due to MVAs <sup>16</sup>. However, this was in a rural town, where probably majority of the people use other means of transport on the reads

other than motor vehicles. The number of males injured due to MVA in this study constituted 70.27% of all the cases of injury. This concurs with the findings in a previous study by Nantulya and Macharia (2009) <sup>11</sup> whereby there was over-representation of males in MVA (73.9%), perhaps attributed to a higher proportion of males travelling on the roads more often than females at any given time. Other studies in other centers have shown a male preponderance in MVAs <sup>8, 9, 16, 29</sup>. MVA as a cause of injury confers significant strain on the health facilities in terms of cost .According to Nantulya and Macharia the poor among the population groups tend to bear a disproportionately higher burden of MVA

The second most common cause of injury in this series was IPV which comprised of 39.1% of all the cases. Both IPV and MVA caused a larger percentage of injuries in men. This concurs with various other studies <sup>6, 7, 8, 12, 40</sup>. Generally most of injuries due to IPV occur on the streets (63.3%), followed by the home setting (17%). A considerable proportion of those injured due to domestic IPV were females, whereas majority of those injured due to non-domestic IPV were males. Females are at a higher risk of being injured at home due to IPV. Cases of child abuse resulting in craniofacial injuries were very few. Most of the IPV-related injuries occur at night. Surprisingly entertainment sports were not the likely sites for IPV. Weapons used in IPV were mainly knives .Other crude ways of inflicting injury like kicks and blows was also significant. Bottles as weapons featured

prominently at entertainment places. The victims of non-domestic IPV were primarily men in the age category of 26-35 years

Regarding MF-STIs sustained by victims who had consumed alcohol 24 hours prior to injury, majority were as a result of non- domestic IPV (61.5%). In a study in the UK 55% of the assault cases were related to alcohol consumption <sup>6</sup>. Alcohol consumption increases the risk of MF injury due to IPV as demonstrated in other studies. <sup>6</sup> The results from this study show that IPV still plays a significant part in the generation of craniofacial trauma in Kenya. In the UK <sup>12</sup> and South Africa <sup>10</sup> IPV was the most common cause of MF injury. Reports from other regions of the world showed that MVAs were the leading cause. <sup>6, 8, 9, 13</sup> In Kenya and Zimbabwe IPV has been reported to be the leading cause of facial fractures, which concurs with the observations made on skeletal fractures in this study. <sup>25, 26, 28</sup> However, compared to MF-STIs MVAs are the leading cause.

Falls as the third major cause of facial injury showed a bimodal distribution in the ages of 13-25 and 36-45 years. Falls from heights were the second leading cause of injury among children less than 12years, whereas MVA was the most frequent cause in this age category. In other studies falls from heights <sup>42</sup> and dog bites accounted for the majority of injuries in the younger age group, but with increasing age, assaults become a major factor <sup>34</sup>. Fall from a height was the leading cause of injury among children less than 5 years which was in agreement with other published literature <sup>34, 37, 42</sup>. Generally the male: female

ratio is **5.4:1**, but was 1:1 in the < 12-year- old children. This is similar to the findings in other studies <sup>37, 34</sup>. In children below 5 years both genders have an almost equal exposure to the etiologic factors and risks of sustaining STIs from falls. Children fall within the home environment whereas similar injuries in adults were in work places or trenches along the roads and quarries more so in the dark. The bimodal distribution among the age groups described in the western literature was not evident in this study. <sup>6, 7, 41, 42</sup> In Kenya the life expectancy is 44 years (WHO country profile 2002) and, therefore, the proportion of the elderly is small.

Human bites constituted a small proportion (3.2%) compared to the other causes of the MF injuries. In the females injuries occurred in the 13-25-year-old and the 26-35-year-old age groups. In males the injuries occurred in the 26-35-year-old age group. In a study in Nigeria, human bites in adolescents have been reported. <sup>37</sup> This affected males and females almost in equal proportions. The degree of injuries was fairly devastating causing multiple lacerations and avulsions.

Over the study period there were very few reported cases of MF-STIs due to animal bites. In this study there was only one case of a donkey bite involving a 5year- old and another case of dog bite in 5- year- old boy who had strayed from home. In other studies, animal-related lacerations were most commonly dogbites in which the peak incidence occurred in children aged less than 10 years with an exponential decay in frequency with increasing age.<sup>8</sup> Other studies in Nigeria showed that majority of the animal bites were inflicted by cows. <sup>30</sup> In Kenya some of the reported animal attacks are mainly dog-bites, and there are sporadic reports of donkey bites and bites by wild animals <sup>43</sup>. Though *devastating, animal bites are less frequent causes of craniofacial injuries* generally.

The frequency of firearm-related injuries and the number of deaths associated with them has been shown to be on the increase in Kenya recently <sup>35</sup>. Fortunately though, firearm-related injuries are not yet among the leading causes of trauma compared to the United States where FAIs are still the second leading cause of injury related deaths.<sup>36</sup> In this study out of the 52 recorded cases 7 affected the MF region. The occurrence of FAI was sporadic and exclusively involved males. More than 50% of all FAIs result in head and neck injuries <sup>35</sup>. According to Odhiambo et al. <sup>35</sup> approximately 30% of these injuries are fatal and men are seven times more likely than women to sustain fatal or nonfatal FAIs.

Only one case of sports related MF-STIs was reported during the period of study. It could be that majority of the population engage in non-contact sporting activities like athletics and as such injuries due to sports are few. Alternatively it could be that majority of those involved in affluent related contact sports that would cause injury are usually treated in private hospitals and, therefore, were missed out in this study. A study by Hill et al. (1998)<sup>19</sup> found that the number of MF injuries that result from sporting accidents is relatively small in relation to the

number of participants. Generally the risk of MF injuries in sporting activities is minimal due to the awareness and application of necessary precautions.

In this study the male-dominant pattern of MF-STIs is comparable to that reported in various studies from the United Kingdom<sup>6</sup> and Malaysia<sup>9</sup>. Studies from Nigeria<sup>13</sup> have reported involvement of men eight times more than women. One study from Pakistan<sup>33</sup> reported a ratio of **5.3:1**. Among men, the third decade of life is an active period when they are more energetic, involved in highspeed transportation and engaged in high risk outdoor activities which are the leading causes of maxillofacial trauma. As a result, like in many other studies, it was in the second and third decade of life that most of the MF injuries occurred.<sup>6,</sup> 9, 13, 33 One of the most striking features of the study was the involvement of the 15-25-year-old age group that constituted 22.2% of the alcohol related injuries. The 26-35 -year-old age group formed the highest proportion of all the cases of IPV related to alcohol. This was the peak age for facial injuries occurring in entertainment spots and on the street and for all MVA and alcohol-related IPV and MVA. Generally, more than three times as many males were injured compared to females.

The commonest forms of injury were simple and multiple lacerations regardless of the etiology. This is consistent with other studies in the UK <sup>6, 7</sup> Malaysia <sup>40</sup> and Nigeria <sup>13</sup>. MVA and IPV were the leading causes of simple and multiple lacerations. Avulsion and crush injuries, which are very devastating forms of

injury were less frequent. Crush injuries were mainly caused by IPV but were also seen in lesser proportions after human bites, MVA and falls. Perforations were mainly caused by MVA and IPV. The high frequency of forehead lacerations correlates to the findings of previous authors, <sup>3, 11, 14</sup> who have quoted the upper facial 1/3 as having been most frequently affected. Crush injury was more frequent in the upper face. Abrasion injuries occurred commonly in the midface. The low incidence of nasal injuries may be related to the cartilaginous nature of the external nose. The relative flexibility of the nasal cartilage may assist in reducing trauma to this structure.

Regarding the distribution of the injuries in relation to the etiology, MVA, IPV and human bites caused the highest frequency of injuries in the upper face and dentoalveolar injuries whereas falls caused the highest frequency of injuries in the mid and the lower faces. The distribution of facial lacerations in the upper, middle and lower facial regions was similar regardless of the aetiology. This observation is similar to that made by Ong and Dudley <sup>7</sup> (1999) in a study in the UK. In this study there were no statistically significant differences in the distribution seen for each aetiology. This indicates that aetiology does not have a profound effect on the distribution of lacerations.

With regard to injury to special areas, the dentoalveolar injury was the most frequent, followed by tongue cuts and eyeball trauma. However, injuries to blood vessels, nerves ,the parotid and submandibular glands were less frequent.

Majority of the MF- STIs were rather superficial, hence the low incidence of injuries to the blood vessels, parotid and submandibular glands.

Associated skeletal fractures occurred in 32.8% of all the MF-STI cases. The mandible was the most commonly affected while the zygomatic bone was the second most common followed by maxillary fractures. The zygomatic complex being a prominent bone of the face is vulnerable to injury. Palatal and nasoethmoidal (NOE) fractures were the least encountered injuries. This is consistent with many other studies <sup>23, 24, 29, 32</sup>. All the types of fractures occurred in association with lacerations predominantly. In this study crush and avulsion injuries were few and occurred concurrently with mandibular fractures mainly.

Regarding fractures occurring without STIs, the male: female ratio was found to have been 6.6:1, which was higher than that recorded for STIs. The leading cause of facial skeletal fractures was IPV, unlike STIs where MVA were the leading causes. This concurs with the observation by Mwaniki et al. (1990) <sup>25, 26</sup> regarding the causes of mandibular fractures. The risk factors for skeletal injury among females were different from those of males, whereas the risk factors for STIs were the same for both males and females. Females sustained fractures predominantly due to MVA and domestic IPV whereas males sustained fractures mainly from non-domestic IPV and MVA involving passengers. The age groups most afflicted were those between the 13-25- and 26-35-year-old age groups

among whom males were the most affected. This trend has similarity with the age distribution for MF-STIs.

The commonest associated systemic injuries were orthopaedic and head injury. These are common injuries resulting mainly from IPV and MVA. Falls resulted in more associated head injuries than orthopedic injuries. Reports from other studies differ. Cannel et al. (1996) <sup>24</sup> found that the most commonly associated systemic injuries were abdominal followed by thoracic injuries. Perhaps this correlates with the differences in the predominant causes of injury. In Kenya MVAs are the leading cause of injury, which predominantly causes orthopaedic injuries whereas in the UK the predominant cause is IPV.

### MF-STIs Injuries in Children

In this study children below the age of 12 years constituted 9.1% of all MF injuries. MVAs were the leading cause of injury in children among whom pedestrians constituted 50%. The findings are similar to those of Ogini et al. (2005) in a Nigerian study <sup>13</sup> though at variance with the findings from studies in western societies. In western societies the patients were found to have been mainly pedestrians, passengers and cyclists.<sup>13</sup> This raises concern over the safety of the children as pedestrians on our roads. In children below 5 years, the leading cause of injury arose from falls from heights , which concurs with other studies which have shown that nearly half of the children injured (42%) were 5-year-olds or younger. In this study 50% of the injuries in children below 12 years

were caused mainly by MVA followed by falls from heights. Injuries due to IPV were comparatively less frequent in this age group. Facial skeletal fractures in the age below 12 years were uncommon (6.4%,) whereas no fractures were recorded at all in children below 5years. The commonest forms of STIs in children below 5 years were simple lacerations and abrasions. This concurs with findings from other studies. <sup>34, 37, 42</sup> Injury in children tends to be minor. The commonest part of the face injured was the lower third. Dentoalveolar Injuries were the commonest associated injuries, which was similar to other studies done in other centers. <sup>34, 37, 42</sup> In this study there were no associated skeletal fractures recorded in children less than 5 years old.

#### Immediate management of the MF-STIs

Majority of the patients received definitive treatment within 24 hours of injury due to easy access to health facilities. Most of the MF-STIs were treated by the maxillofacial residents and interns whereas a few were attended to by A&E surgeons and nurses. There appeared to have been no proper protocol as to who should attend to patients with MF-STIs. Use of antibiotics and tetanus toxoid was haphazard, with 50.7% of the respondents having been given antibiotics upon treatment and only 38.6% were given tetanus toxoid. Thus there appeared to have been lack of proper protocol regarding the use of antibiotics and tetanus prophylaxis. Majority of the cases of MF- STIs only required simple closure, whereas about one third required closure in layers. Most of the injuries were simple lacerations that did not run deep.

Further stabilization of fractures (displaced and undisplaced) was undertaken as secondary procedures. Only 0.9% had immediate open reduction and internal fixation of the fractures. The A&E department is well equipped to handle orthopaedic emergencies but has not put facilities in place for MF emergencies. This is an oversight regarding appropriate treatment of craniofacial injuries. According to Carnell et al. <sup>24</sup> early intervention to stabilize grossly displaced or comminuted facial bone fragments has the positive benefit of producing easier management of convalescent patients and avoids temporary or permanent facial deformity. To allow such emergency interventions trained staff should be readily available to participate in multidisciplinary decisions and operations.

The most widely utilized imaging modality was plain radiography 66.9%), mainly to detect skeletal injuries. CT scans were utilized primarily for patients with head injuries. Utility for MF injury per se was minimal. Eric et al. (2005) <sup>18</sup> observed that facial fractures are commonly missed on initial plain imaging evaluation. Of the patients with MF-STIs 10.1 % were admitted to hospital which compares with findings from a study in the UK <sup>6</sup> where admissions were at 8% .Those admitted had other systemic injuries. While most patients with MF-STIs underwent unplanned operations with the least possible delay, in seven patients emergency surgery to the maxillofacial area was undertaken as part of a multidisciplinary intervention. During the period of study three patients suffered multiple life threatening injuries leading to mortality.
Emergency interventions in patients with MF injury were for securing of the airway and for arrest of haemorrhage. This concurs with another study by Cannell et al. (1994) <sup>24</sup> in which it was found that patients with MF injuries underwent emergency surgery to control continued life-threatening haemorrhage, stabilize grossly displaced mandibular fragments and secure the airway. Intubations were required in seven patients all of whom had sustained head injuries. The most frequently consulted clinicians for multiply injured patients with MF-STIs were ophthalmologists, neurological, orthopedic and ENT surgeons. The involvement of different specialists calls for a protocol for the management of multiply injured patients whereby the team leader is clearly identified.

#### CONCLUSIONS

Based on the findings of this study the following conclusions were made.

- Notably, MVA and IPV were the principal causes of the MF-STIs and MF-STIs heavily outnumber MF skeletal fractures, a finding that is consistent with other studies on MF injury in developing countries.
- Males were more afflicted than females while lacerations were the commonest type of MF-STIs whereas orthopaedic and head injuries were the commonly associated systemic injuries.
- Most of the MF-STIs were managed by dental interns and maxillofacial residents although there was no clear protocol in place for the usage of antibiotics and tetnus toxoid while stabilization of associated MF fractures was generally undertaken as a secondary procedure.

# RECOMMENDATIONS

- Measures should be put in place to improve road safety standards.
- The A&E department at the KNH should facilitate appropriate immediate treatment of MF injuries in general and there should be a protocol in place for the usage of antibiotics and tetnus toxoid in patients with MF-STIs.
- Peripheral health facilities should be utilized to treat most of the MF-STIs that put considerable unnecessary strain on the referral hospital.

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#### A. Bio data

Initials of Patient's Name ..... Hospital Number .....

1. Age...... 2. Gender.....

3. Place of residence...... 4.. Date of injury.....

# B. Circumstances of injury

- 1. Duration between injury & treatment.....
- 2. Day of the week when injured.....

3. Period of the day when injured Day..... Night.....

4. Place of injury: Home ...... Place of work.....

Streets...... Place of intertainment.....

Others.....

#### C. Cause of Injury:

1. MVA Pedestrian Passe	enger Motor cyclist			
2. Gunshot 3. Interpersonal violence	(non domestic)			
4. Interpersonal violence (domestic)	5. Interpersonal violence (child abuse)			
6. Sports injury	7. Fall from height			
8. Animal bites v. Domestic animals	specify			
w. Wild animalsspecify				
9. Human bitesOthers				

D. History of Alcohol usage within 24h before injury.....

#### E. Anatomical site of the MF region injured

1.Upper face	2.Midface
3.Lower face	4.Panfacial (upper. mid. lower face combined)
5.Neck	6. Scalp

#### F. Involvement of internal anatomical regions in the head and neck

# G. Intraoral involvement

1. tongue ....., 2. Dental-alveolar injuries....., 3. Mucosal injuries......

#### H. Associated Injuries outside MF region

#### I. Types of wounds in MF soft tissue Injuries

1.Clean	wound	2.contaminated	wound	 3.Necrotic
wound	4. Simple	lacerations		
5. multiple I	acerations	6. abrasions		
7.Avulsions		8Perforations		
9. Crush inj	uries			

#### Involvement of Special areas

1.	Nerve injuries 2		Injuries to the arteries	
3.	parotid gland4	1.	sub mandibular gland	
5.	Parotid duct injuries 6		Injuries to the eyeball	
7.	Injuries to the ears	3.	Injuries to the eyelids	
9.	Upper lips10.	. 1	lower lips	

# K. Associated skeletal injuries

1. Frontal bone fractures..... Isolated Midfacial fractures:-

5. NOE6.Palatal7Panfacial	
Part of Mandible injured : -	
8. Condyle9.Ramus 10.Body 11.Coronoid	
O Imaging Modality Utilised	* ********
1.CT2. Plain X rays	
3.MRI4.Angiography5.Ultrasound	
P. Immediate treatment done	
Consultation	
1. ENT 2.ophthalmologist	
3. neurosurgeon 4.cardiothoracic	
5. general surgeon6.Orthopaedic surgeon	
Q Definitive Management	
1. Soft tissue repair within the first 8 hours of injury	
2. Soft tissue repair 72 hours after injury	
3. Repair with Soft tissue reconstruction	
4. Antibiotics	
6.Open reduction & internal fixation of skeletal injuries	
7. Soft tissue repair only	
8. Soft tissue repair immediately and skeletal fixation later	****
R Attending personel:	

U. Reason for emergency surgery:

1. Airway obstruction.....

2 .surgical toilet.....

3 .Control of haemorrhage.....

V. Hospital admission .....

W Emmegency treatment

Tracheostomy......Intubation...... Blood transfusion......Chest tube sertion.....

Diagrams illustrating the MCFONTZL system of recording the distribution of facial soft tissue injuries



Modified MCFONTZL classification of soft-tissue injury. F: forehead; O: orbit; C: chin;N: nose; L: lip (upper and lower); E: ear; Z: zygoma.

#### Appendix B - CONSENT FORM

(1) I, Dr Edalia of the University of Nairobi collage of Health Sciences, will be conducting a study on Craniomaxillofacial Soft tissue injuries due to variety of causes. I would kindly request for your participation, by providing some information as outlined in the questionnaire shown to you. All the information provided will be handled with confidentiality. Patient's name will not appear on the questionnaire to ensure privacy.

(2) Risks :- There will be no risks involved because invasive procedures will not be performed and the entire clinical examination will be carried out under absolute hygienic measures.

(3) Benefits:-The study will help us in improving care of trauma victims with facial injuries who may have similar cases . Information from the study and follow up studies will also help provide options for preventive measures and resource planning.

(4) This agreement is voluntary and without coercion and further consent to the free use of this information and conclusion drawn among health professionals and any other persons involved in the improvement of human life.

(5) I.....(self) confirm that I have understood the relevant parts of the study and do hereby give consent of participation and accept willingfully to provide information regarding my condition, to be used in the research being conducted by Dr Edalia. I understand that I will be provided with optimum clinical care like all other patients in the hospital, and will not be provided with any form of compensation for the voluntary information I have given to the investigator.

Sign..... date.....

(6) I..... (Parent/guardian in case of a minor/ mentally incapacitated individual) give consent of participation and accept willingfully to provide information regarding my dependant's condition to be used in the research being conducted by Dr Edalia

Sign..... Date .....

Appendix C – Consent form in Kiswahili language

#### CHETI CHA KUTOA RUHUSA

(1) Sababu ya utafiti

Mimi, Daktari Edalia, kutoka Chuo Kikuu cha Nairobi, kitengo cha Matibabu,nafanya utafiti kupata kujua aina ya majeraha ambayo hupatikana kwa sehemu za usoni na kichwani, na pia kutambua kinacho sababisha hayo majeraha miongoni mwa majeruhi. Ninahitaji kufahamu jinsi hayo majeraha yalivyotokea. Utafiti unahusu uchunguzi wa kidaktari na kujibu maswali ili kuhakikisha kikamili kuhusu majeraha yaliyopatikana.

(2) Matatizo

Hakuna matatizo yoyote yanayotarajiwa kutokana na utafiti huu kwani utafanyika kwa hali ya usafi sanifu, na baada ya kupeana dawa ya kuzuia uchungu panapohitajika.

(3) Mafanikio

Utafiti huu utatusaidia kuboresha utunzi wa majeruhi wengine ambao wanaweza kuwa na majera kama hayo. Matokeo pia yatachangia kupangilia mwelekeo wa kuboresha huduma za matibabu hayo katika hospitali kuu.

(4) Kuhusishwa

Kuhusika ni kwa hiari yako. Unao uhuru wa kuuliza maswali kuhusu utafiti huu. Ninakushukuru sana kwa uamuzi wowote utakaochukua pamoja na muda wako ambao umenipatia. Pia habari hizi zitasaidia kuboresha hali ya wale wengine ambao watakuwa na majeraha kama hio siku za usoni.

(5) Mimi......(mgonjwa) nathibitisha kwamba nime elewa maana ya utafiti unao endeleza na daktari Edalia,na na kkubali kutoa habari yagu kwa hiari kuhusu hali yangu ya majeraha. Habari iliyotolewa kwa Utafiti wote utakuwa bila malipo.

Sahihi...... Tarehe.....

(6) Mimi..... ( iwapo ni mtoto au akili isiyo timamu) nime kubali kutoa habari kuhusu ninaye mtunza ,kwa hiari lili kutumiwa katika utafiti wa Daktari Edalia

Sahihi.....Tarehe.....

# Appendix D BUDGET

SERIAL	ITEM	AMOUNT IN Kenya Shs
1.	Stationery	60,000
2.	Library/Journals	20,000
3.	Internet & surfing	10,000
4.	Staff costs	140,000
5.	Miscellaneous/unforeseen	25,000
	Total	255,000

# APPROVAL BY THE RESEARCH AND ETHICS COMMITTEE

Appendix E



KENYATTA NATIONAL HOSPITAL

Hospital Rd. along, Ngong Rd. P.O. Box 20723, Nairobi. Tel: 726300-9 Fax: 725272 Telegrams: MEDSUP", Nairobi. Email: <u>KNHplan@Ken.Healthnet.org</u> 13th August 2009

Ref: KNH/UON-ERC/ A/286

Dr. Edalia K. Bernard Dept.of Oral & Maxillofacial Surgery School of Dental Sciences University of Nairobi

Dear Dr. Edalia

# RESEARCH PROPOSAL: "AETIOLOGY AND PATTERN OF OCCURANCE OF CRANIOMAXILLOFACIAL SOFT TISSUE INJURIES TREATED AT A MAJOR REFERRAL HOSPTIAL IN NAIROBI" (P169/6/2009)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and <u>approved</u> your above cited research proposal for the period 13<sup>th</sup> August 2009-12<sup>th</sup> August 2010.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

DR. L. MUCHIRI <u>AG. SECRETARY, KNH/UON-ERC</u> c.c. The Chairperson, KNH/UON-ERC The Deputy Director CS, KNH The Dean, School of Dental Sciences, UON Supervisors: Dr. Walter Odhiambo, Dept.of Oral & Maxillofacial Surgery, UON Dr. Mathew Akama, Dept. of Oral & Maxillofacial Surgery, UON Prof. M. Chinda, Dept.of Oral & Maxillofacial Surgery, UON Dr. Bernard Mua, Dept.of Period. & Community Health, UON