

# MBCHB VI STUDENTS CRANIOFACIAL TRAUMA LECTURE NOTES

VIRTUAL LECTURE GIVEN ON 22/03/2021

# OVERVIEW OF CRANIOMAXILLOFACIAL TRAUMA

PROF SW GUTHUA

22/03/2021

MBCHB VI

# LECTURE OBJECTIVES:

At the end of this lecture, learners are expected to;

1. Outline the common **aetiological factors** in Craniomaxillofacial Injuries (CMFI).
2. Discuss the **clinical presentation and emergency care** of patients presenting with Craniomaxillofacial Injuries (CMFI).
3. State the **various investigations in patients** presenting with Craniomaxillofacial Injuries (CMFI).
4. Outline the **various management modalities** of patients presenting with Craniomaxillofacial Injuries (CMFI) including fractures of the upper face, midface and Mandible.
5. State **the complications** that may arise from Craniomaxillofacial Injuries (CMFI).

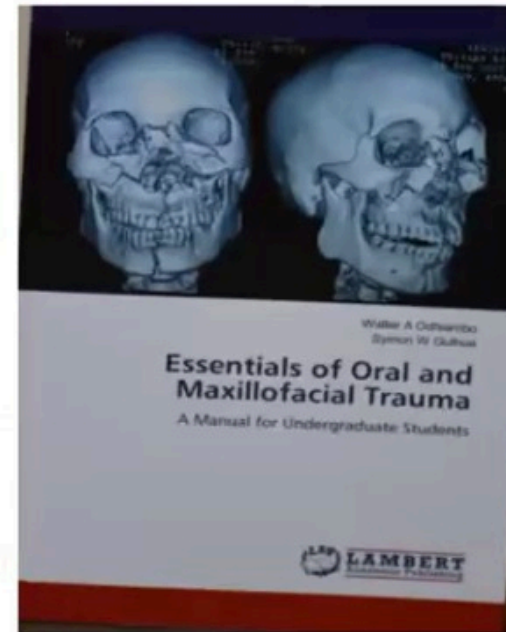
# CLINICAL PRESENTATION AND ANATOMY

## ANATOMY



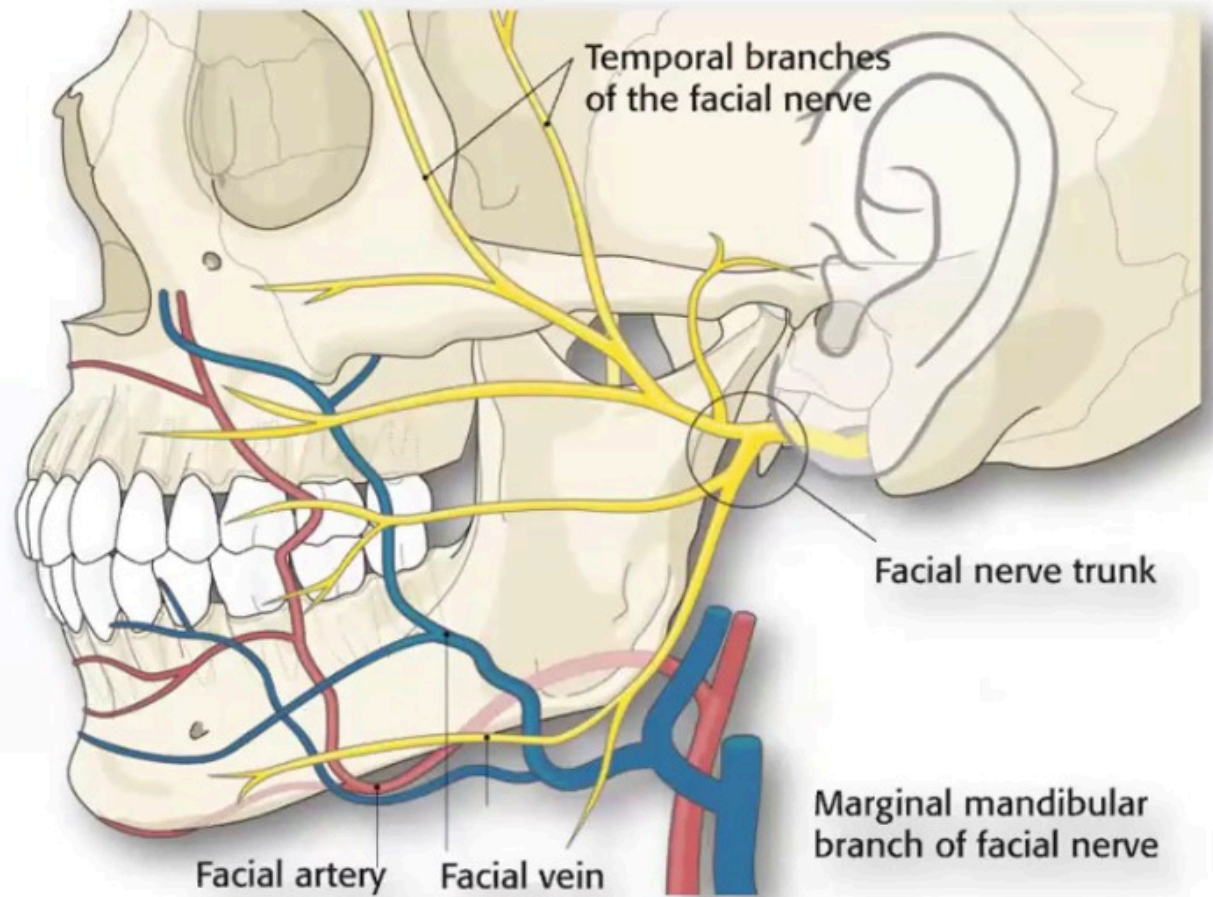
# BOOK (2018/2019): ESSENTIALS.....

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Reference BOOK

# ANATOMY : FACIAL NERVE



# Functions of the Facial Skeleton

- protect the brain
- house and protect the sense organs
- facilitate eating, facial expression, breathing, and speech
- facial identity

## **OCCURRENCE OF FACIAL FRACTURES (In Order of Frequency)**

- **Nasal Bones**
- **Mandible (10<sup>th</sup> in the body)**
- **Zygomatic Arch**
- **Maxilla**
- **Zygomatic Complex**



# AETIOLOGY OF CRANIOMAXILLOFACIAL INJURIES

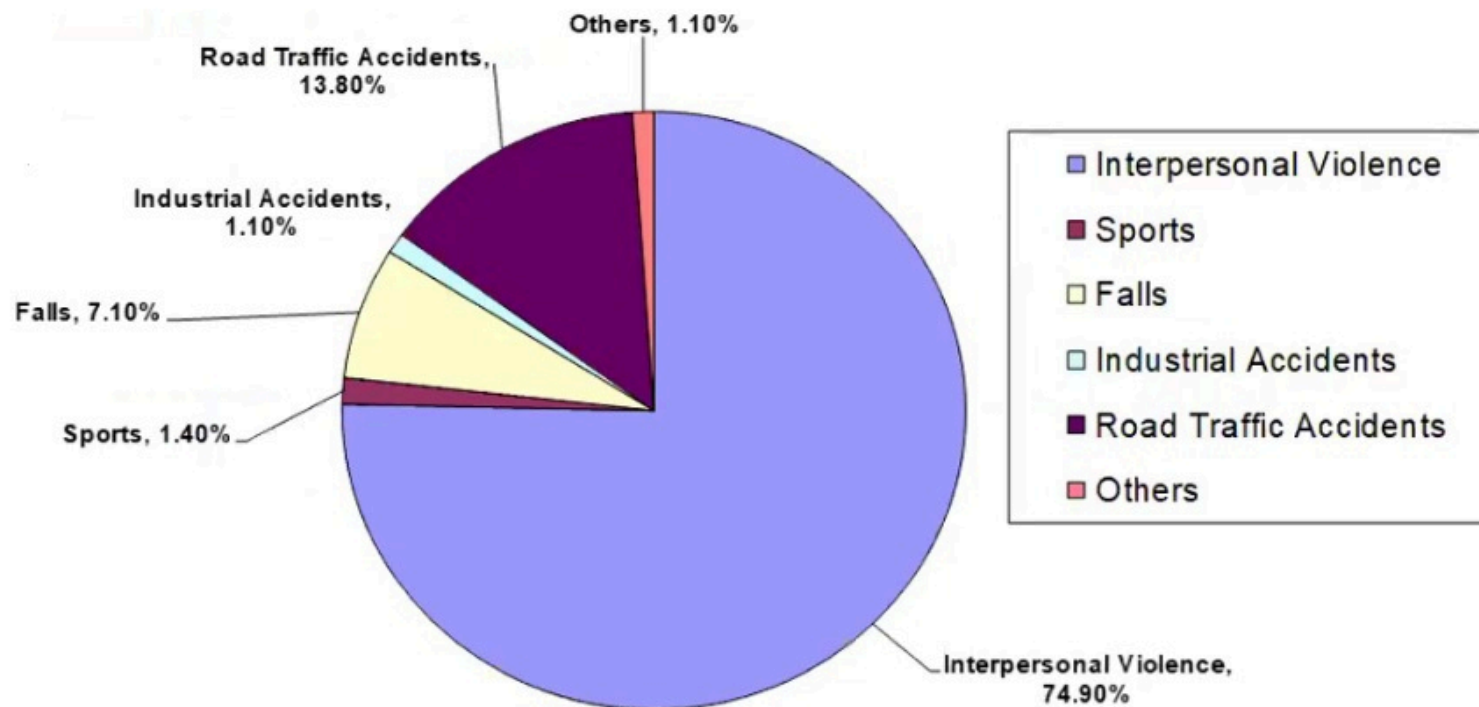
- Interpersonal Violence
- Road Traffic Accidents (RTA)
- Fall
- Hit by a Sharp Object
- Gunshot
- (RTC & Gunshot – Cause More Severe Injuries)
- Others (Animal Injuries)

# CRANOIMAXILLOFACIAL INJURIES: AETIOLOGY IPV

- FIGHTS : ASSAULTS
- FLYING OBJECTS THROWN
- SPORTS (CONTACT SPORTS-RUGBY,ETC)
- DOMESTIC VIOLENCE (SPOUSE/PARTNER/CHILDREN)
  - GUNSHOT (DOMESTIC VIOLENCE / ASSAULT)
  - HUMAN BITES



# FACIAL INJURIES DISTRIBUTION OF ETIOLOGIC FACTORS



Mwaniki & GUTHUA, 1990, British Journal of Oral Maxillofacial Surgery

Prof Guthua

## DISTRIBUTION OF INJURIES ACCORDING TO ETIOLOGICAL FACTORS (MFI STUDY 2002)

FACTOR	FREQUENCY	%
Unknown	2	1.3
RTA	53	34.9
IPV	77	50.7
Occupational	1	0.7
Falls	10	6.6
Sports	5	3.3
Others	2	1.3
Not indicated	2	1.3
<b>TOTAL</b>	<b>152</b>	<b>100.0</b>

(AKAMA, M.K., GUTHUA, SW. etal, Afr. Journal of Oral Health Sciences.  
Vol 4 (3) Nov/Dec. 2003)

## OCCURRENCE AND PATTERN OF MAXILLOFACIAL INJURIES CAUSED BY MOTORCYCLE CRASHES PRESENTING AT TWO MAJOR REFERRAL HOSPITALS IN NAIROBI, KENYA

Simba Nyameino, BDS, MDS<sup>1</sup> ;Fawzia Butt, BDS, FICD, FDSRCS, MDS-OMFS<sup>2,3</sup>  
Symon W. Guthua, BDS ,MMED SC, DOMS, FIAOMS, FCS<sup>4</sup> Francis Macigo, BDS, MPH<sup>5</sup>  
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**Journal of Craniomaxillofac Trauma Reconstruction Open**  
**2018;2:e9–e14.**

# FACIO-MAXILLARY FRACTURES IN CHILDREN

## ▪Low incidence

- Difference in size between cranium / facial skeleton (sinuses, protective thick adipose layer)
- About 5% of all facial fractures (less in children < 5 years of age; 1 %)
- Common fractures (falls, play, RTA, sports)
  - ✓ Nasal bones (46.6%)
  - ✓ Mandible (24%; condyle: 9%)
  - ✓ Orbital blow-out (1%: Hall et al 1983)

## WHY LOW INCIDENCE?

- Relatively smaller facial size
- Flexible bony skeleton
- Incomplete formation of the maxillary sinuses



# ROAD TRAFFIC CRASH (ACCIDENT)- RIFT VALLEY



01/03/2019



## MAIN FACTORS THAT CAUSE RTA

- Human errors (85% of MVAs)
- Mechanical factors (6% of RTAs) = General condition of the vehicle
- Traffic environment (9% of RTAs) = About 1.2% due to road defects

# ANIMAL BITES

- Unvaccinated domestic animals (dogs, cats)
  - ✓ ANTIRABIES PROPHYLAXIS (Flanigan et al 1985, Corey 1983)
  
- Farm Livestock (rabbits, rodents) rarely carry rabies
  - ✓ ANTIRABIES PROPHYLAXIS (Flanigan et al 1985, Corey 1983)

# CHEETAH



S.W.G  
Prof Guthua

18

19

# ANIMAL BITES MICROBIOLOGY

Bacteroides  
and  
fusobacteria,  
Mixed  
infection  
aerobes and  
anaerobes  
25%

Pasteurella  
multicida  
25%

Alpha-  
haemolytic  
streptococci  
40%

Staph. Aureus  
10%



# PROPHYLAXIS



## Tetanus & Rabies

- All patients (n=10) 0.5ml T.T
- Mutilated Injuries (n=5) – from lions, leopards  
--- Vaccinated against Rabies



# VACCINATION

## Rabies and Mutilated Injuries (n=4)



- Inactivated Rabies vaccine prepared on Verocells  
(Verorab)
  - Dosage: 5 x 0.5ml (approx 2.5 I.U)
  - Route: I.M (Deltoid)
- Course: Days D0, D3, D7, D14 and D28
  - Booster Dose: D90 (optional)



# REFERENCES

- 1. GUTHUA, S.W.:** Complex maxillofacial trauma caused by Wild Animals in Kenya; Int. J. Oral & Maxillofacial. Surg. 1999; Suppl. No.1. 28, 81. (Abs).
- 2. GUTHUA, SW, KAMAU, M.W. and MACIGO F.G.** Severe Cranio-Maxillofacial injuries caused by wild animals in Kenya (case series). African Journal of Oral Health Sciences (2016) ; vol. 2 (3): 11 – 14.

# ESTABLISHING A DIAGNOSIS

# DIAGNOSIS

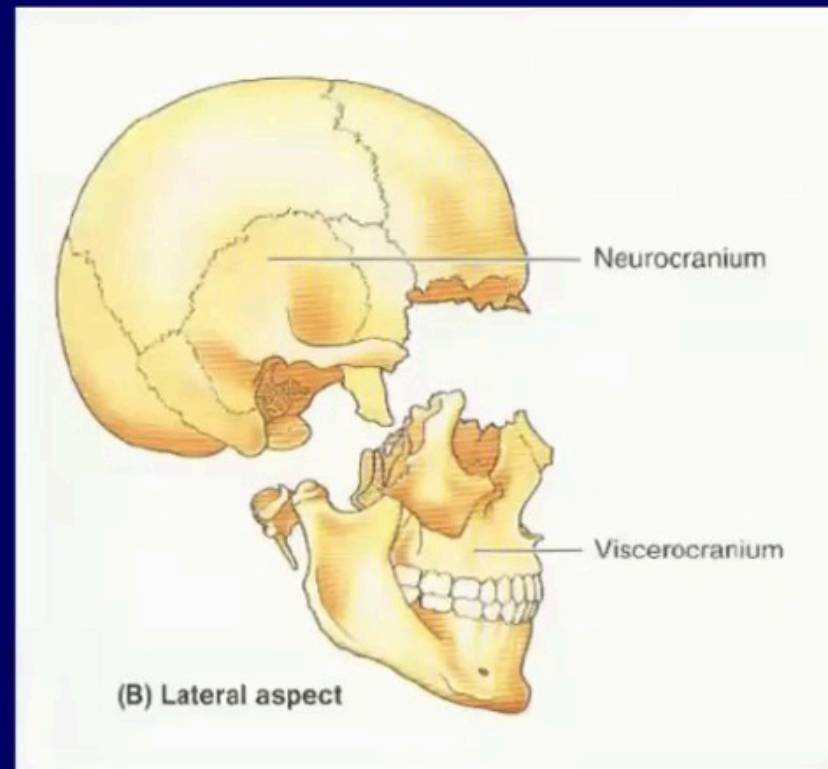
- History (event(s) prior to trauma)
- AMPLE
- Clinical Exam
- Signs and Symptoms
- Appropriate Investigations



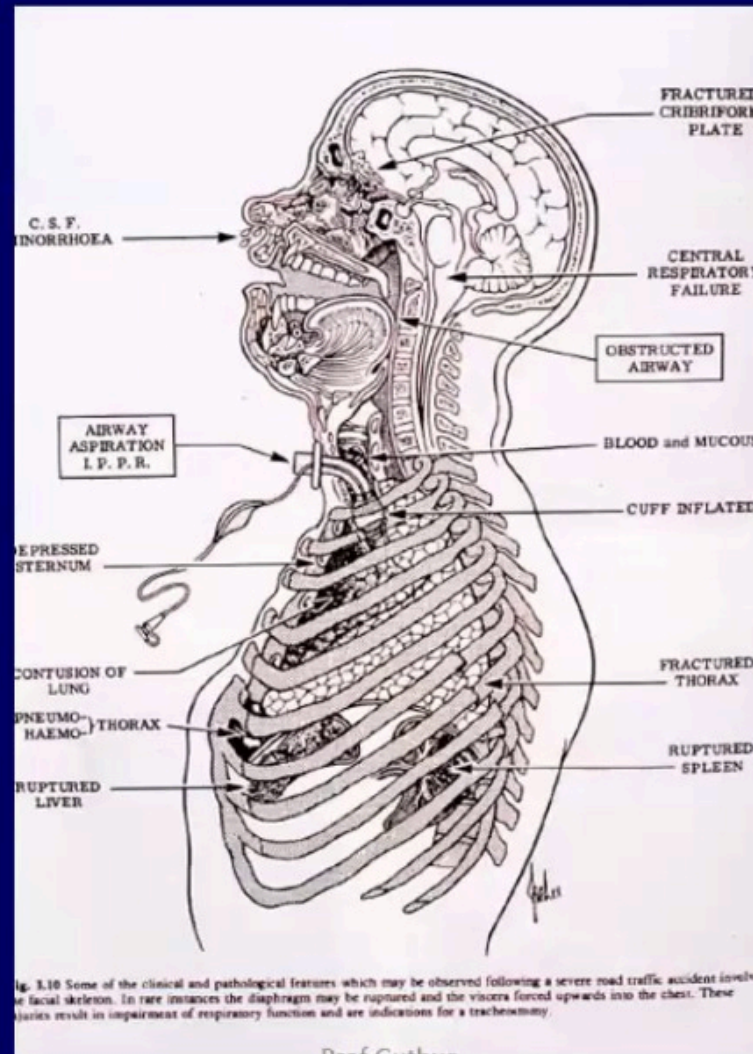
**GUTHUA, S.W. 1990**

# Viscerocranium

- Nasal
- Lacrimal
- Maxilla
- Palatine
- Vomer
- Zygomatic
- Mandible



# MFI – LIFE THREATENING INJURIES



Prof Guthus

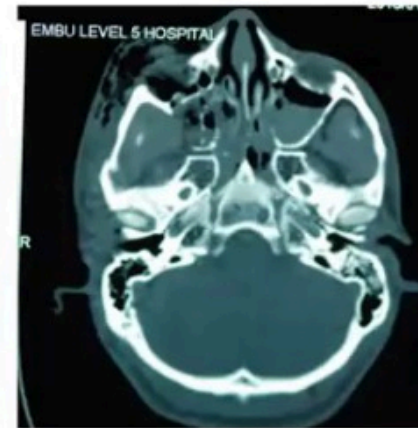


# EXAMINATION : MOTORCYCLE ACCIDENT



08/02/2018

Prof Guthua



Prof Guthua

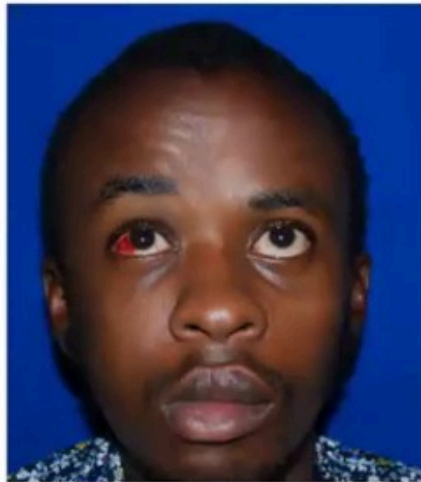


# EXAMINATION : MOTORCYCLE ACCIDENT



08/02/2018

Prof Guthua



CRANIAL BASE FRACTURE

Prof Guthua



# SEVERE HEAD INJURY WITH RT FRONTAL CONTUSION AND INTRACEREBRAL HAEMATOMA



A

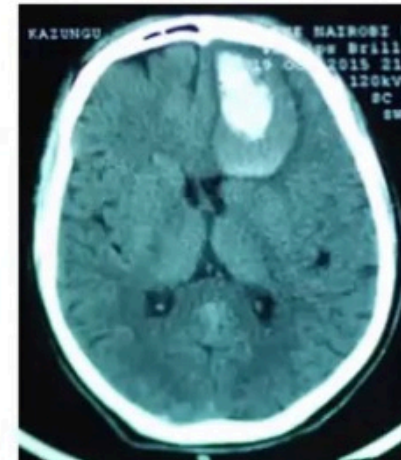
26/10/2015



B

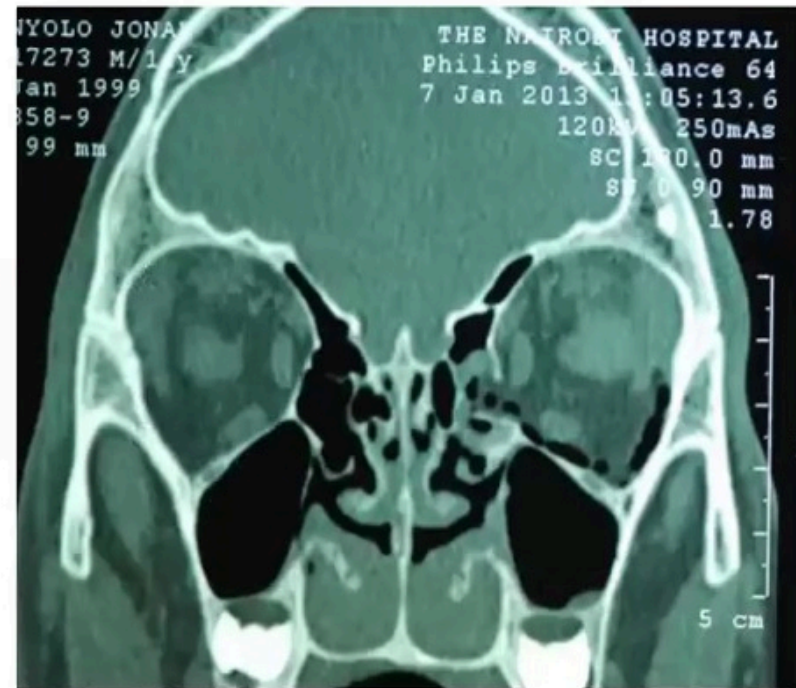
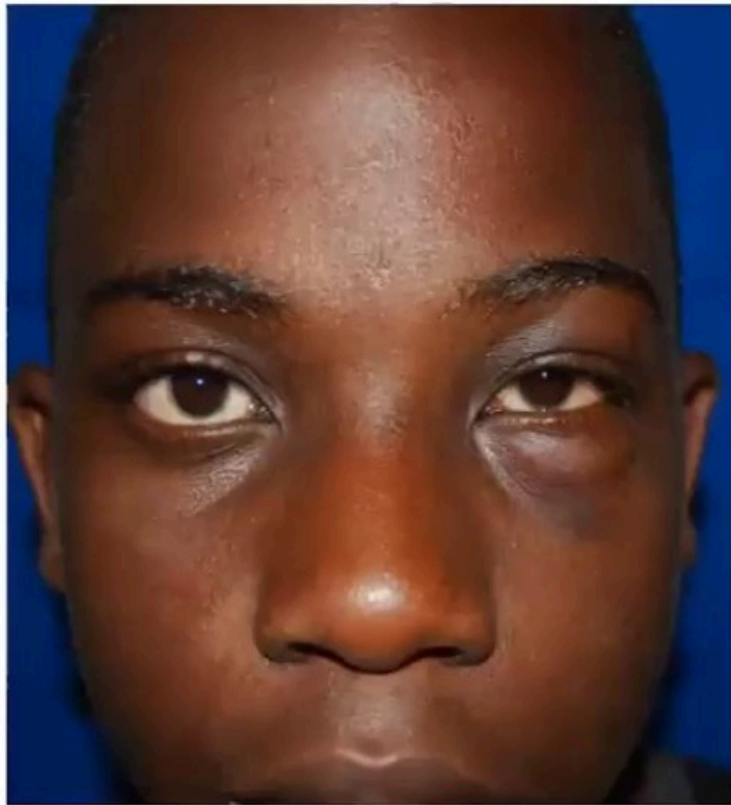


C



D

# BLOWOUT ORBITAL MEDIAL WALL WITH ORBITAL AEROCELE



At presentation

Prof Guthua

Prof Guthua

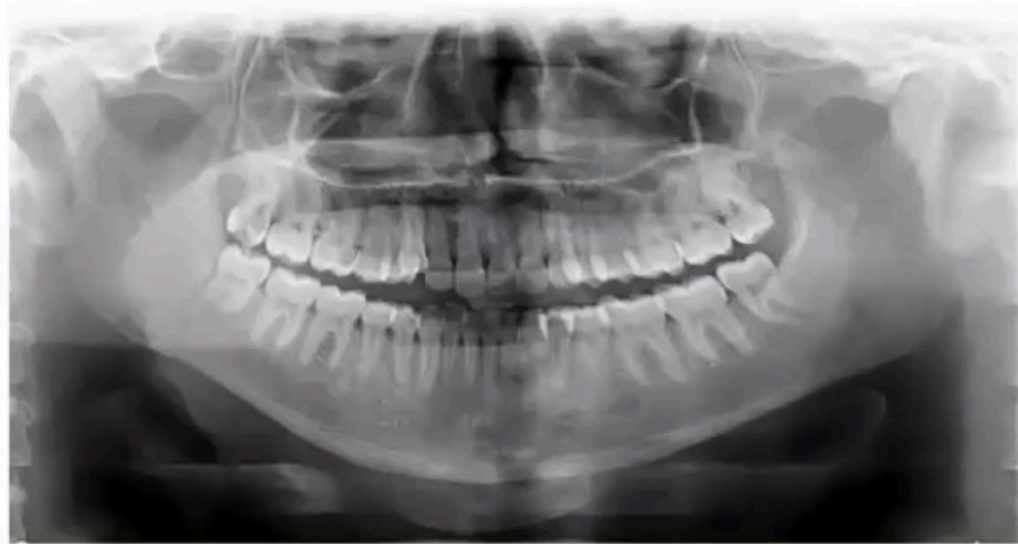


# MANDIBULAR FRACTURES AND FACIAL INJURIES : Motorbike accident



22/01/2020

A



B

## **DISTRIBUTION OF OTHER ASSOCIATED INJURIES**

### **(MFI STUDY 2002)**

<b>ASSOCIATED FRACTURE/INJURY</b>	<b>FREQUENCY</b>	<b>%</b>
<b>Skull fracture and head injury</b>	<b>49</b>	<b>57.6</b>
<b>Upper limbs</b>	<b>14</b>	<b>16.5</b>
<b>Lower limbs</b>	<b>13</b>	<b>15.3</b>
<b>Ribs / thorax</b>	<b>3</b>	<b>3.5</b>
<b>Others</b>	<b>6</b>	<b>7.1</b>
<b>TOTAL</b>	<b>85</b>	<b>100.0</b>

**(AKAMA, M.K., GUTHUA, SW. etal, Afr. Journal of Oral Health  
Sciences. Vol 4 (3) Nov/Dec. 2003)**

Prof Guthua  
S.W.G



# MANAGEMENT

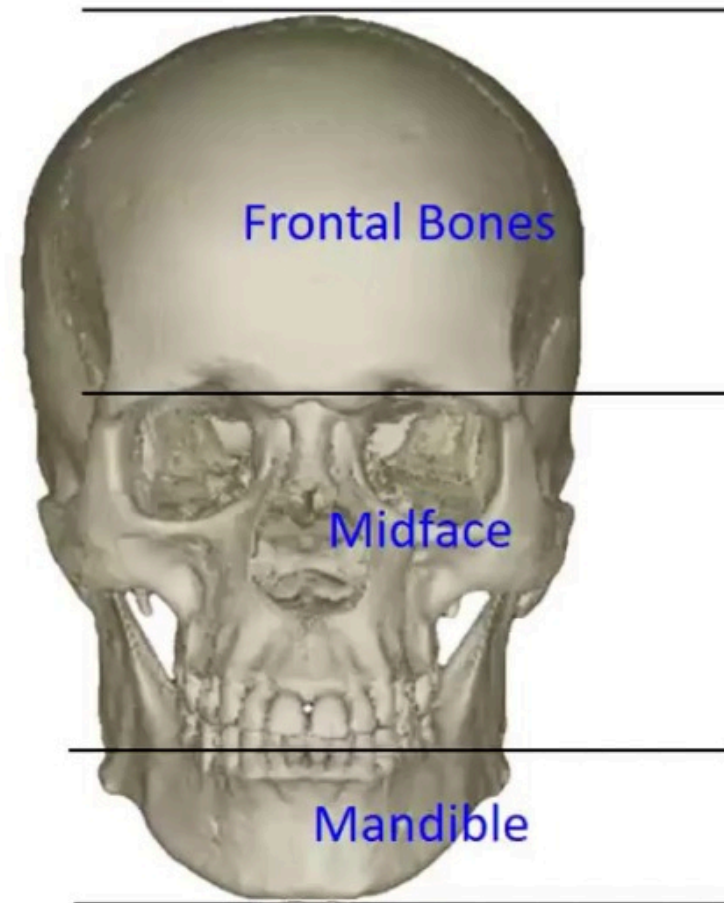
## Facial Skeleton

3 Areas

Frontal

Midface

Mandible



## EVALUATION AND CARE OF TRAUMATIZED PATIENTS (ATLS PROGRAM)

**STMP = Structured Trauma Management Program :**

**Dr James Styner , Orthopaedic Surgeon, USA, 1978**

# ATLS principles

- Developed in 1978 to ensure uniformity in the triage and treatment of injured patients
- ATLS consists of 5 basic principles:
  1. **Assessment of Airway, Breathing and Ventilation, Circulation, Disability, and Exposure;**
  2. Do no harm;
  3. Early treatment of life-threatening injuries;
  4. Frequent assessment;
  5. Surgeon maintenance of a high index of suspicion for injuries.

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*Advanced Trauma Life Support (ATLS) Student Course Manual 9<sup>th</sup> Edition. American College of Surgeons, 2012.*

# EVALUATION AND CARE OF TRAUMATIZED PATIENTS (ATLS - STMP)

## I. PRIMARY SURVEY ABCDE

- A Airway maintenance and C-spine control /Protection
- B Breathing and Ventilation
- C Circulation with Bleeding control (haemorrhage control)
- D Disability /Neurological Assessment
- E Exposure and Environmental control

## II. RESUSCITATION

- Management of life- threatening problems

## III. SECONDARY SURVEY

- Total evaluation of patient (head, skull, maxillofacial, neck, chest abdomen, perineum / rectum , etc
- Head-to-Toe evaluation of Trauma patient

## IV. TERTIARY SURVEY / DEFINITIVE CARE

- Careful Management of Injuries : head, thorax, spine & spinal chord, abdomen, etc.

Adopted from Structured Trauma Management Program (STMP) Dr. James Styner ,Orthopaedic Surgeon



# TRIMODAL PATTERN OF DEATH FOLLOWING TRAUMA (TRUNKEY, DONALD, USA).

## **1<sup>ST</sup> PEAK (IMMEDIATE DEATH) ( $\approx$ 50% of trauma deaths)**

- Wide spread brain or cervical cord damage.
- Severe damage to the heart or the major blood vessels.
- Multiple injuries (prevention – ROAD SAFETY)

## **2<sup>nd</sup> PEAK (EARLY DEATHS ( $\approx$ 30% of trauma deaths)**

- First few hours after injury.

### **Golden hour (s) of trauma**

- Deaths here are preventable and are the **main target of ATLS.**

## Causes 2<sup>ND</sup> PEAK

- Facial injuries leading to Airway obstruction
- Lethal disruption of breathing mechanism.
- Collapse of the circulation following heavy blood loss into the body cavities or multiple fractures of large bones like the femur.
- CNS dysfunction usually due to intracranial bleed.

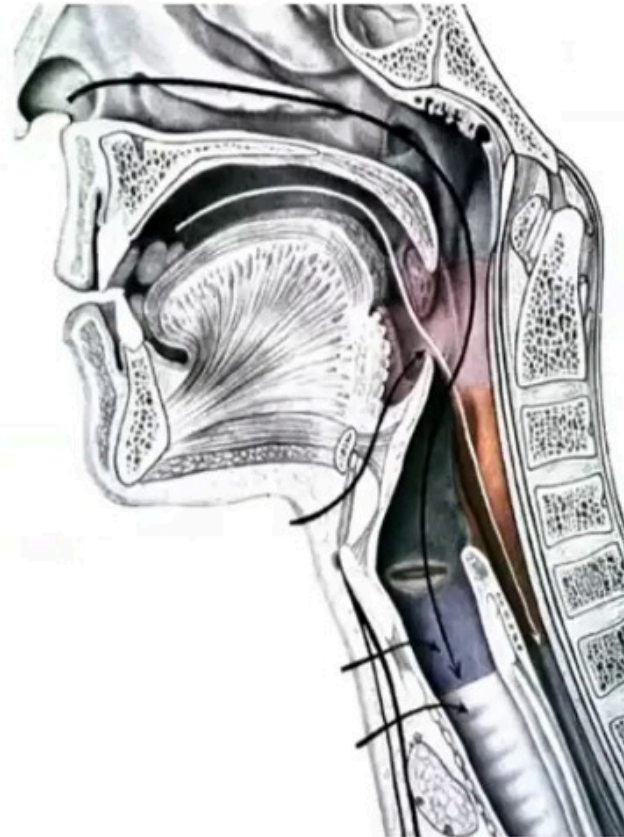
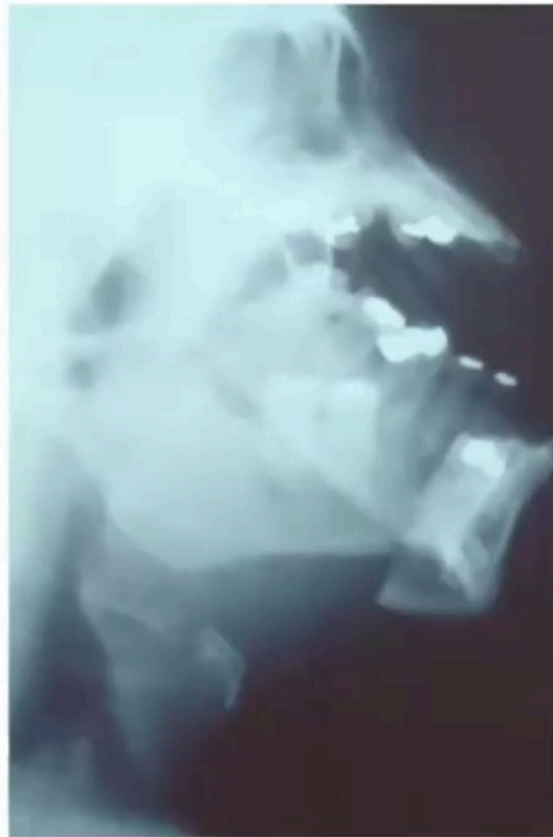
## 3<sup>RD</sup> PEAK (LATE DEATHS) (≈ 20% of trauma deaths).

- After days or weeks after injury.
- Severe infection (sepsis)
- Multiple organ failure (the heart, the kidney, the liver, the lungs, the brain or the haemopoietic system).

## PRIORITIES DURING INITIAL ASSESSMENT

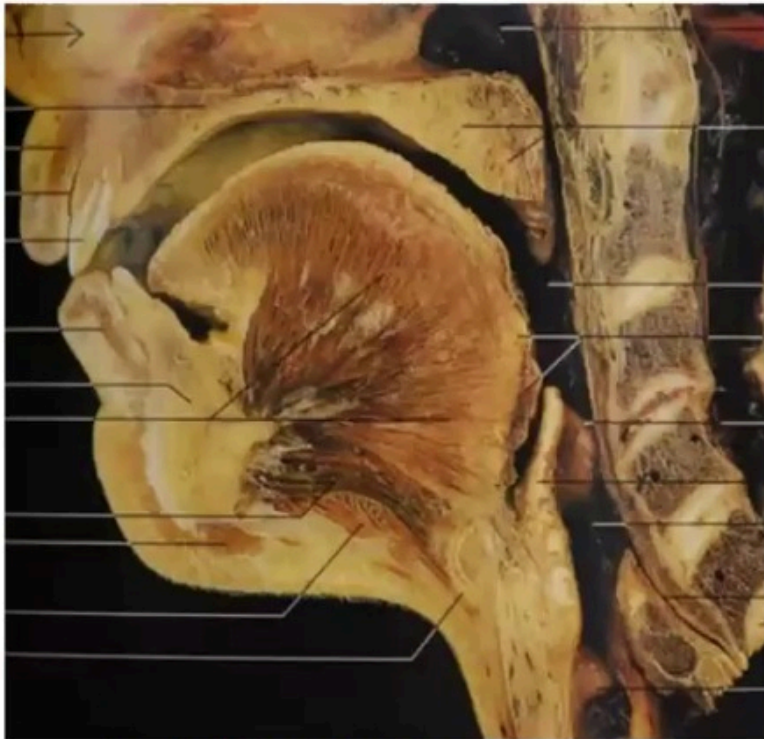
- A** → **AIRWAY** maintenance with **C-spine** protection
- B** → **BREATHING** and **Ventilation**
- C** → **CIRCULATION** with hemorrhage control
- D** → **DISABILITY** (neurologic evaluation)
- E** → **EXPOSURE** and environmental control

# MANDIBULAR FRACTURES AND THE AIRWAY





# LOSS OF TONGUE SUPPORT AND AIRWAY OBSTRUCTION



**NORMAL ANATOMY**

Rohen and Yokochi, 1988



**LOSS OF TONGUE SUPPORT**

Rowe and Williams, 1985



**Complex Injuries : MCCRASH**



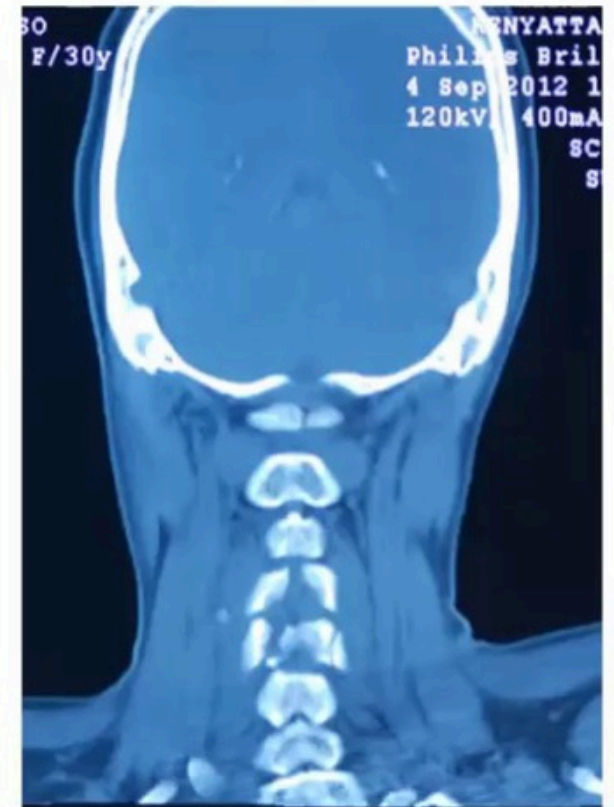
## CERVICAL SPINE FRACTURES: Control



1987



1989



Sept 2012

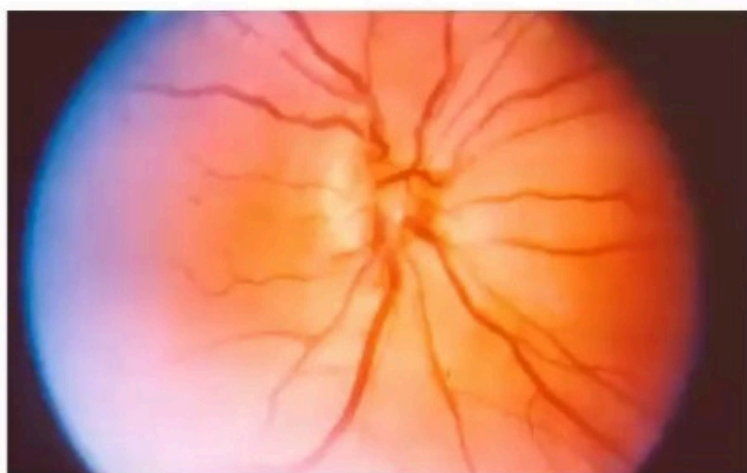
(Cont.)

# Periorbital Soft Tissue Repair

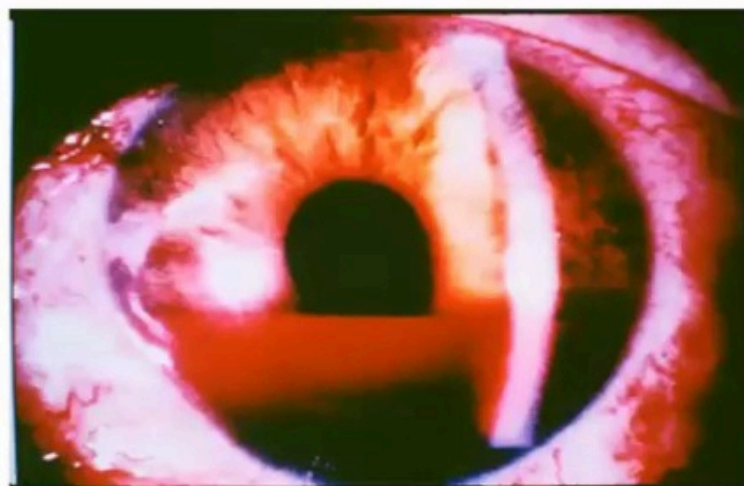


**Missing Right Upper Eyelid & Eyebrow**

# EYE EXAMINATION MANDATORY IN CMF TRAUMA: EYE INJURY



**EYE EXAMINATION**



**HYPHEMA**



# MULTIDISCIPLINARY APPROACH



## **MAIN OBJECTIVES (MF INJURIES)**

- Preservation of vision (sight)
- Restoration of function
- Restoration of aesthetics
- To satisfy the psychological needs

# ESSENTIAL ELEMENTS IN GOOD LACERATION REPAIR

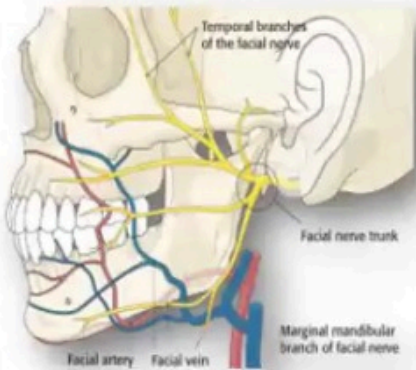
- Secure haemostasis
- Remove foreign bodies
- Excise dead tissues (not radical debridement –H&N)
- Accurate apposition of the remaining tissues in their correct anatomical position (avoid strangulation –approximate!)



## ESSENTIAL ELEMENTS IN GOOD LACERATION REPAIR

- Obliterate all dead space
- Repair of injured specialised structures before wound closure
- (Face: Facial Nerve & Parotid Duct)

# DEEP CUT IN THE MIDFACE



BEFORE ASSAULT



AFTER

## GOALS OF FRACTURE MANAGEMENT

- Achieve anatomical reduction & stabilization
- Re-establish pretraumatic functional occlusion
- Restore facial contour and symmetry
- Balance facial height & projection (reduction –closed or open)

## **FRACTURES OF THE MID-FACE**

- **Le Fort I, II, III**
- **Zygomatic Complex + Arch**
- **Nasal Bones**
- **Nasoethmoidal**
- **Naso –orbito –ethmoidal**
- **“Blow-out”**



# Facial Buttress System



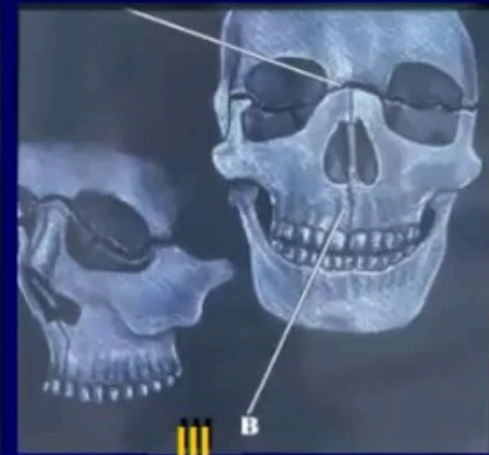
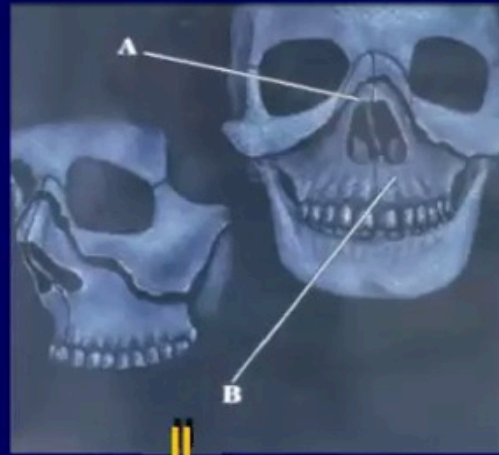
- Nasomaxillary
- Zygomaticomaxillary
- Pterygomaxillary



- Sup. orbital rim
- Inf. orbital rim
- Alveolar ridge




# CLASSIFICATION OF MIDFACE INJURIES:



# Bone Biology

- Support Cells (osteoblasts and osteocytes)
- Remodeling Cells (osteoclasts)
- Collagen (Type I) and proteins
- Inorganic minerals – 65% (HA)



Bone Matrix  
- Osteoid

# BONE HEALING

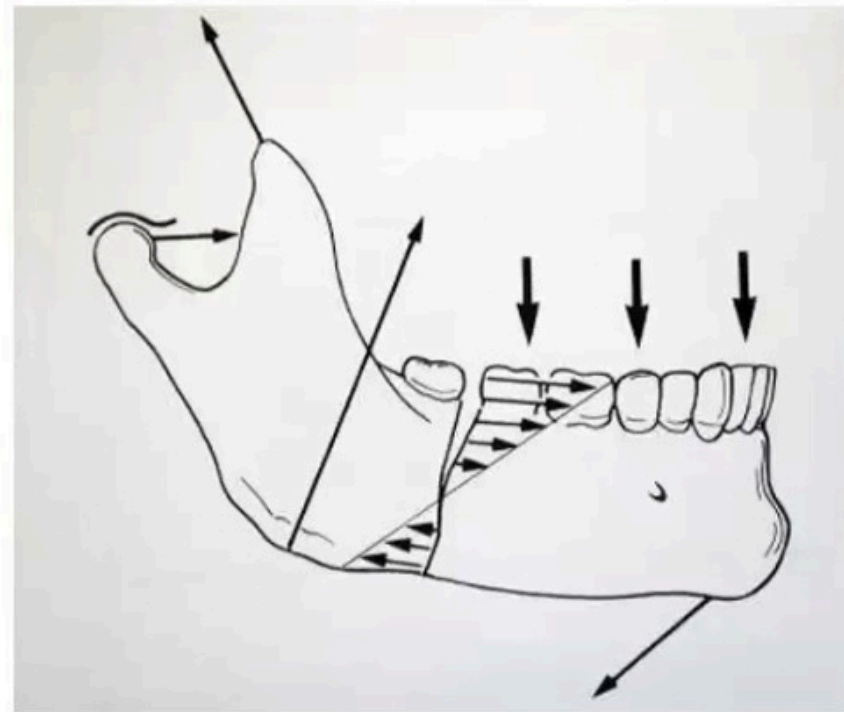
- STIMULATION OF THE ACTIVITY OF OSTEOBLASTS (PIEZOELECTRIC EFFECT).
- COMPRESSION AND ELONGATION (Leads to Electrical changes at the boundaries of Hydroxyapatite Crystals – **Stimulates the Osteoblasts**)
- UNDERSTAND THE MOLECULAR LEVEL ACTIVITY.

# Mandible

- Only mobile bone in CF skeleton
- Main stress bearing bone
- Closest to a tubular bone with thick cortical shell and relatively decreased blood supply

# Biomechanics

- Superior border of the mandible is the **TENSION** zone
- Inferior border of the mandible is the **COMPRESSION** zone

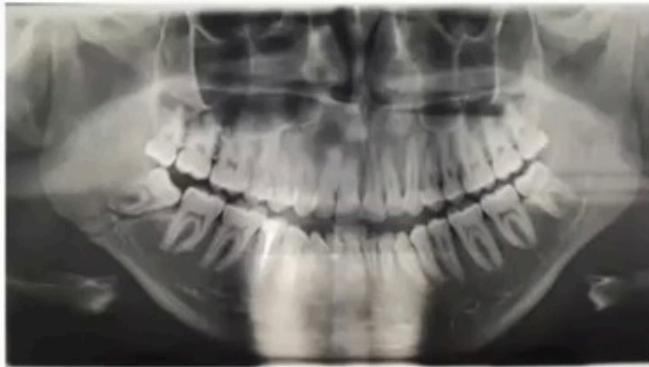




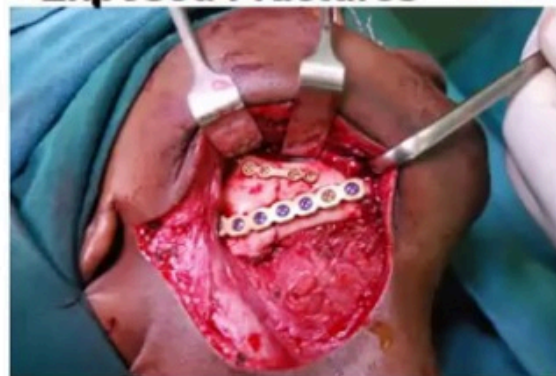
# RIGID FIXATION

- Rigid fixation is a concept and is used for anatomic reduction and adequate fixation for function, not just the use of plates and screws

## COMPOUND COMMINUTED MANDIBULAR FRACTURES:



**Exposed Fractures**

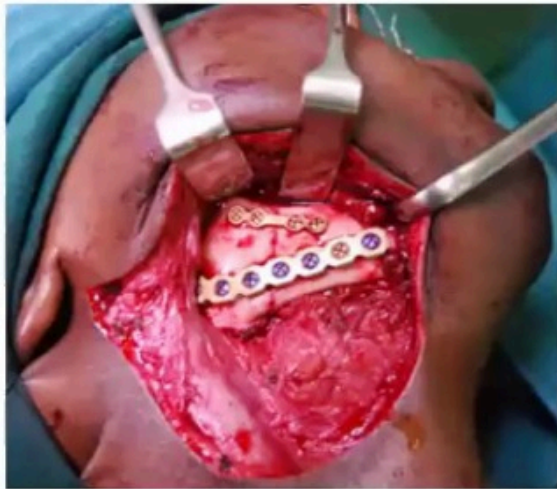


**Two level Fixation**

### SURGERY

- Open Reduction and Rigid Internal Fixation (ORIF)
- Two level Fixation:
  - Upper border=2.0mm Titanium plate&2.0 mm screws(6.0mm)
  - Lower border=2.4 mm weight bearing plate& 2.4mm screws(14,16,and 18 mm.)

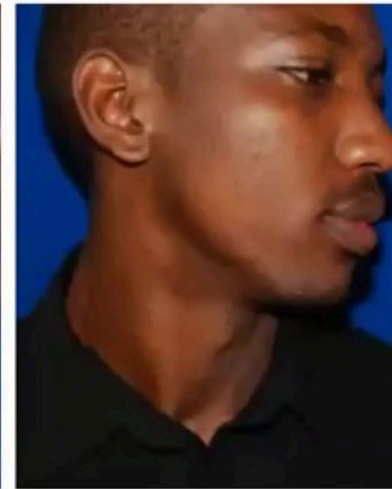
## COMPOUND COMMINUTED MANDIBULAR FRACTURES:



**Intraop-Fracs Repaired**

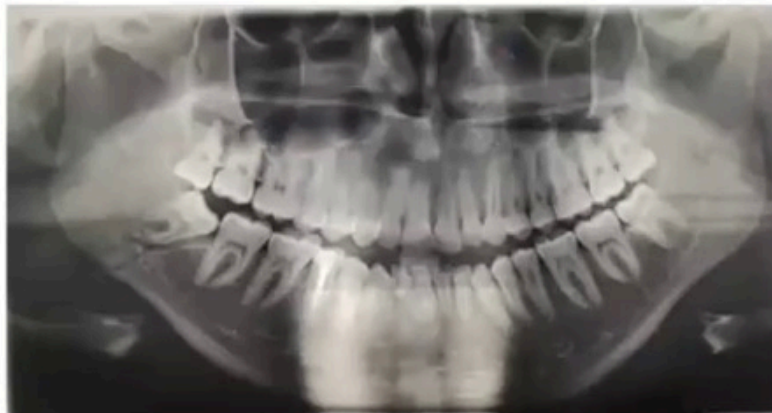


**Postop Submand Scar  
(10 Days Postop)**



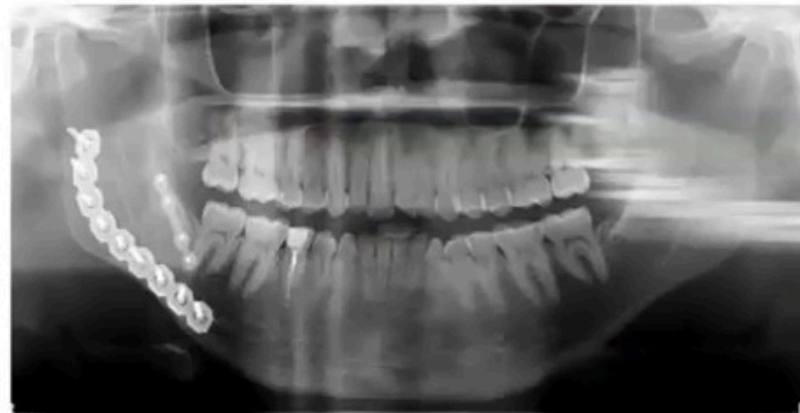
**Postop Scar  
(18 months later)**

## COMPOUND COMMINUTED MANDIBULAR FRACTURES:



PREOP 01/12/2009

7.5 YEARS



POSTOP 22/07/2017  
(ASSAULTED AGAIN TODAY)



# PAEDIATRIC MAXILLOFACIAL TRAUMA



DENTOALVEOLAR TRAUMA-  
SPLINTING



AFTER  
(4 Weeks Later)



Cont

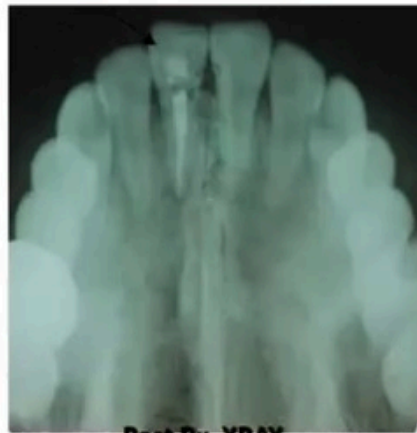
# REIMPLANTATION AFTER AVULSION OF A PERMANENT MAXILLARY CENTRAL INCISOR - H.S.



**Recipient Socket**



**Splinted with wire & composite**



**Post Rx XRAY**



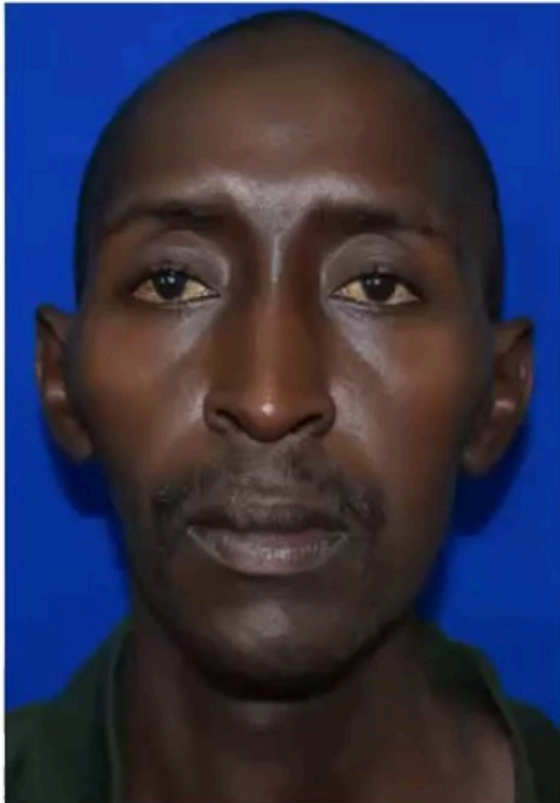
**Treatment Completed**

Prof Guthua  
*(Prof Guthua & Dr. Gicuhi)*

## COMPLICATIONS

- **Malunion / Nonunion**
- **Facial Deformity ( “dish” deformity)**
- **Diplopia ( 3.4 –8 % )**
- **Enophthalmos ( 3 % ) –“blow -out”**
- **Blindness ( 1.3 –2.1%)**
- **Superior orbital fissure syndrome  
(Ophthalmoplegia, upper lids ptosis, proptosis  
fixed dilated pupil)**
- **CMJ/TMJ Ankylosis- a serious complication**

# NONUNION OF AN ANGLE MANDIBULAR FRACTURE

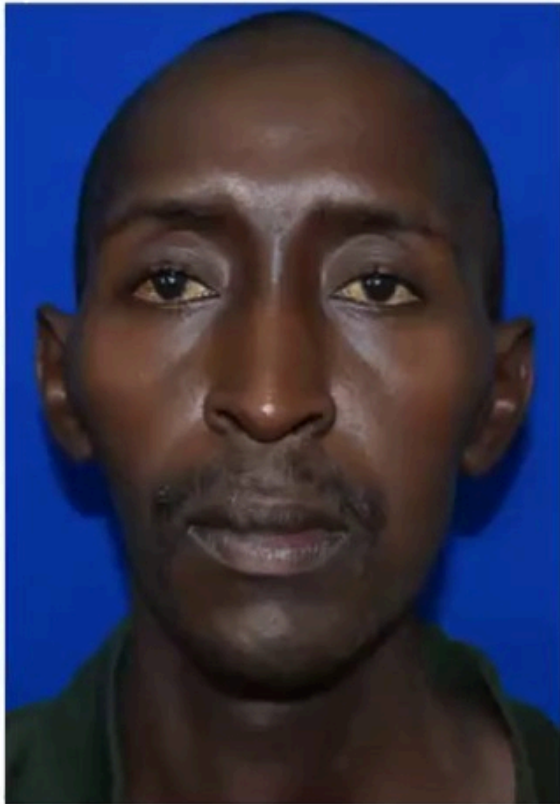


10/03/2021: AFTER ASSAULT 4 MONTHS AGO

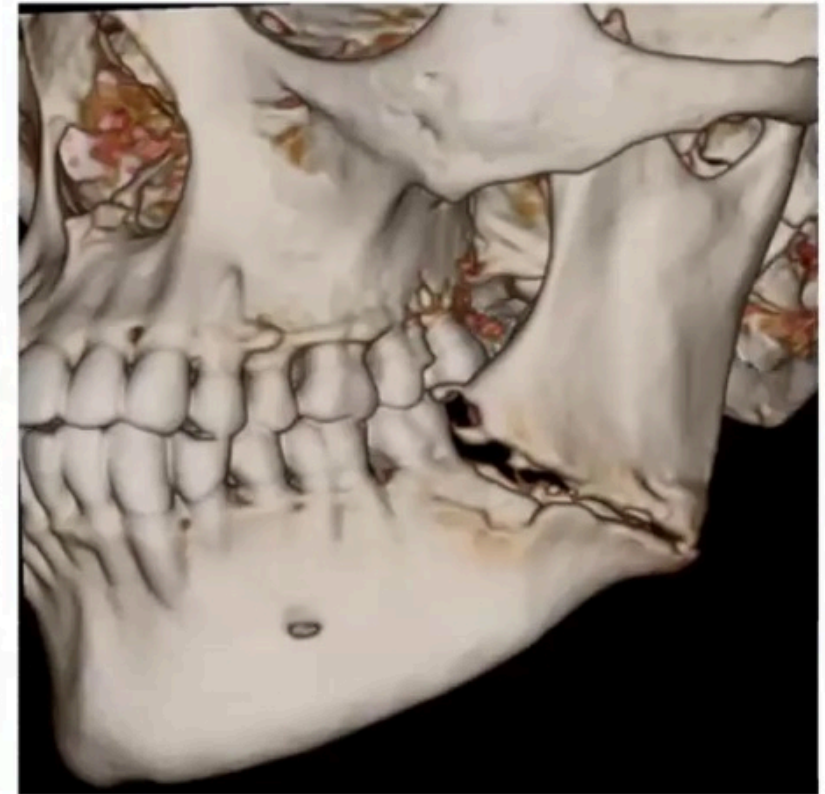
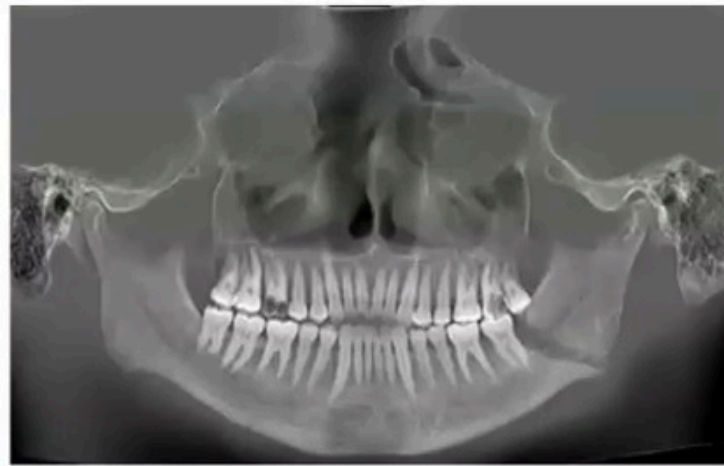
Prof Guthua



# NONUNION OF AN ANGLE MANDIBULAR FRACTURE



10/03/2021



# TRAUMATIC SALIVARY FISTULA-LT MIDFACE

SIDE : STI - unrepaired Parotid duct



17-YEAR OLD ,M



AT PRESENTATION (26/07/2014)



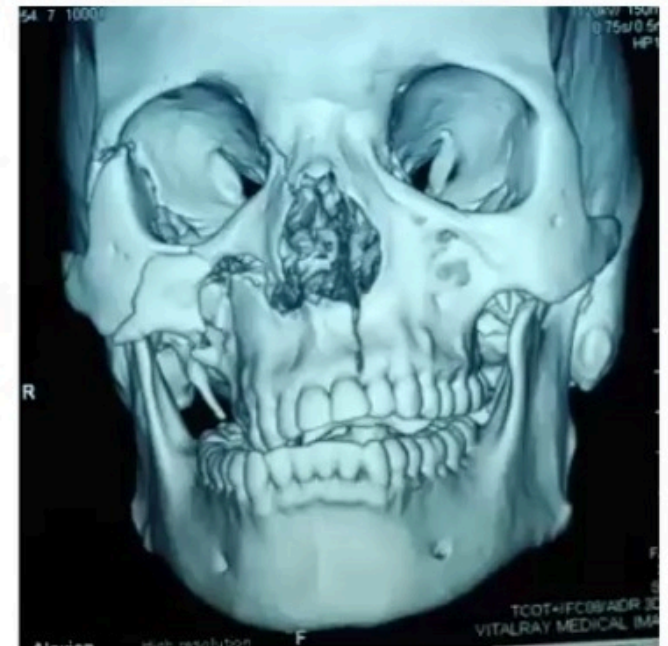
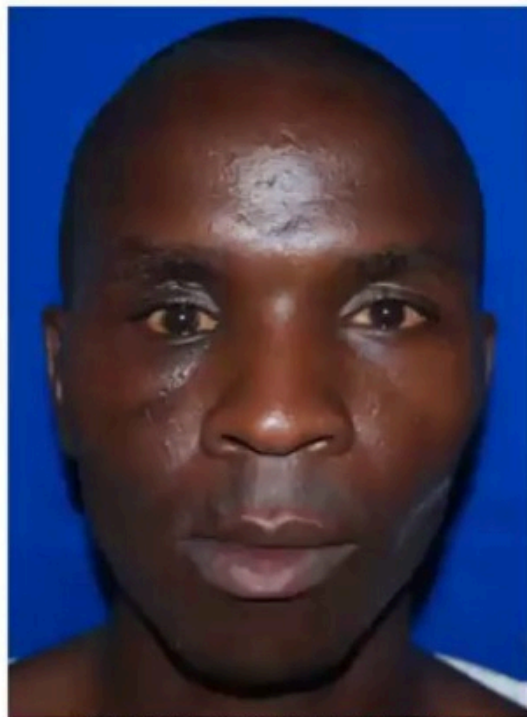


## **PUBLICATION** : An Anatomic Study of the Facial Nerve Trunk and Branching Pattern in an African Population= FACIAL NERVE INJURY

- Francis Mutahi Thuku, BDS, MDS-OMFS<sup>1</sup> Fawzia Butt, BDS, FDSRCS (ENG)E, FICD, MDS-OMFS<sup>2</sup>
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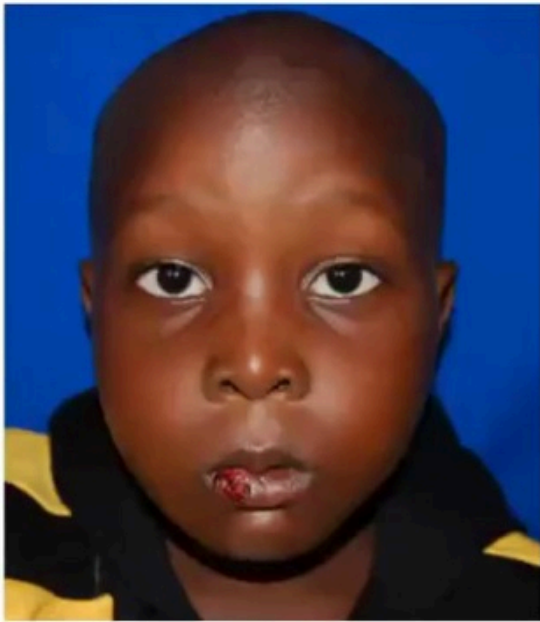
*Craniomaxillofac Trauma Reconstruction Open 2018;2:e31–e37.*

# COMPLEX MIDFACE INJURIES: MOTORBIKE ACCIDENT- MALUNION

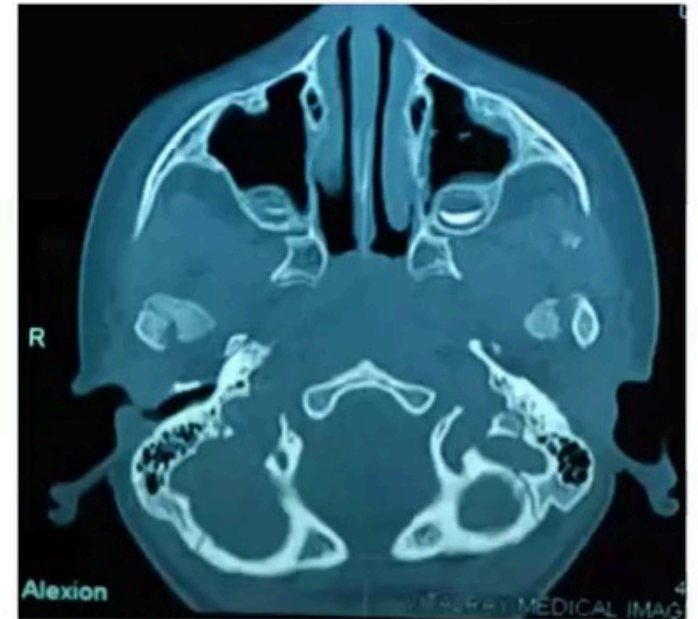
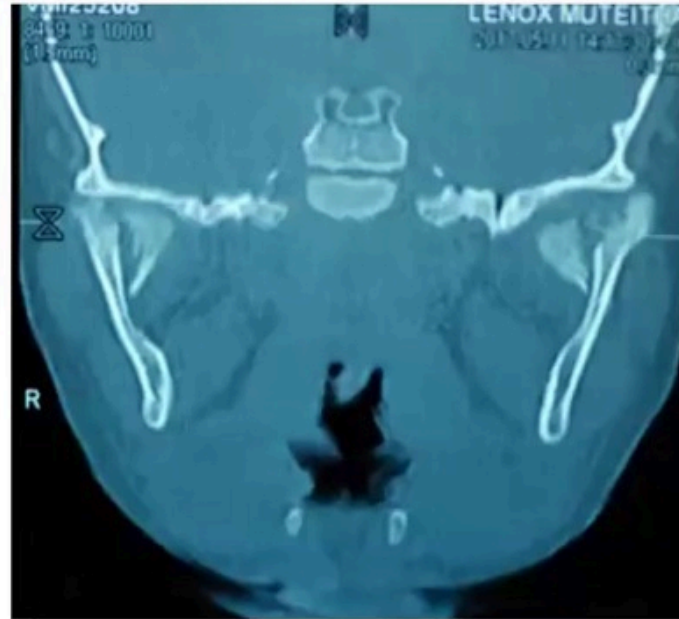


■ NYAMEINO, S., BUTT, F, **GUTHUA, SW**, MACIGO, F, AKAMA, M: Occurrence and Pattern of Maxillofacial Injuries caused by Motorcycle crashes presenting at two major Referral Hospitals in Nairobi, Kenya. J Cranio-Maxillofacial Trauma Reconstruction. Open Journal (2018)2: e9 – e14.

# BILATERAL MANDIBULAR CONDYLAR FRACTURES IN A CHILD



17/05/2017

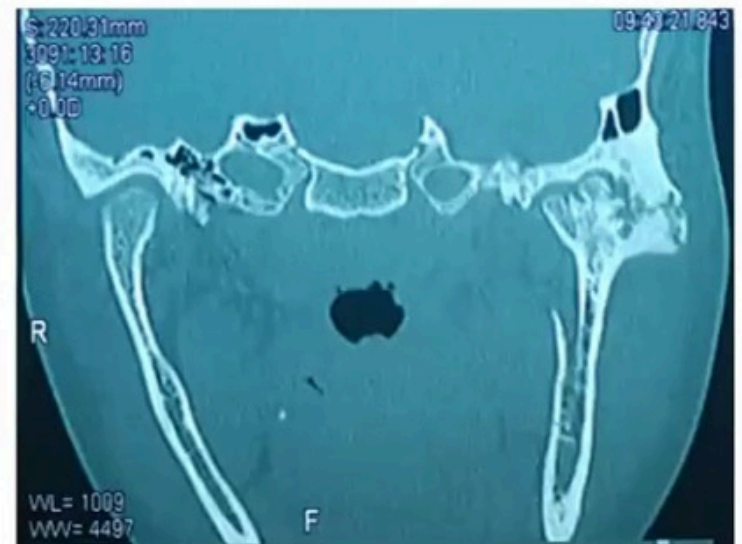
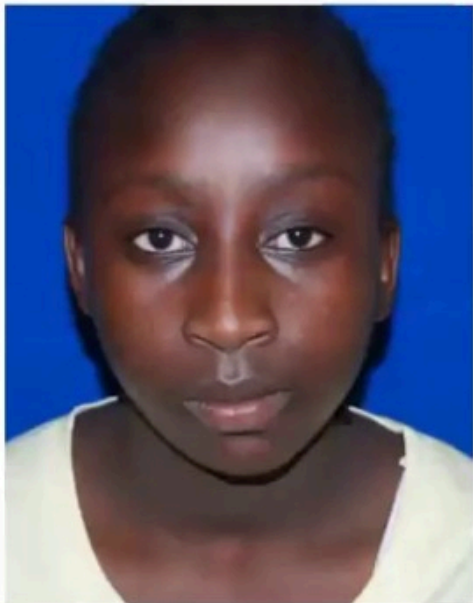


## **Factors predisposing to post-traumatic ankylosis.**

- Age (10 years and below)
- Prolonged immobilization.
- Meniscal perforation.
- Site and type of fracture.



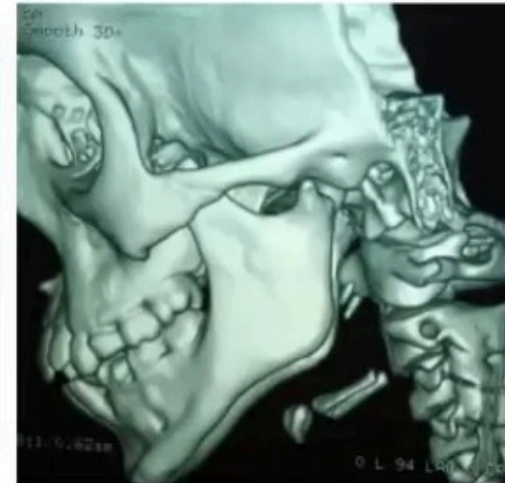
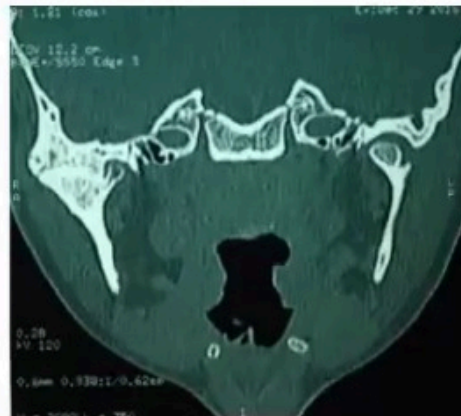
# CRANIO-MANDIBULAR JOINT( CMJ/TMJ) ANKYLOSIS - UNILATERAL -



Lt CMJ Ankylosis following Trauma



# BILATERAL CMJ/TMJ ANKYLOSIS



18/01/2017

# TMJ/CMJ ANKYLOSIS

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- GUTHUA, S.W., MAINA D.M., KAHUGU M., Management of Post-traumatic temporomandibular joint ankylosis in children: Case Report East. Afr. Med. J 1995; 72(7): 471-475.
- BUTT, FM, GUTHUA, S.W. and KEGEREKI, EM: Preliminary outcome of case series of the management of Unilateral and Bilateral Craniomandibular Ankylosis in Kenya: An ongoing prospective study. Open Journal of Stomatology, 2015, 5, 227 – 233  
<http://www.scirp.org/journal/ojst> (<http://dx.doi.org/10.4236/ojst.2015.59028>)
- AKAMA M.K., GUTHUA, S.W, CHINDIA, M.L, and KAHUHO, S.K.: Management of Bilateral Temporomandibular Joint Ankylosis in children: Case report. East Afr. Med. J. 2009; 86 (1): 45 - 48.
- AKAMA, M. and GUTHUA, S.W.: Challenges and Management of Posttraumatic TMJ Ankylosis in Children and Adolescent. International Association of Oral and maxillofacial Surgery Course Nairobi Kenya. October 2<sup>nd</sup> 2009.
- AKAMA M., GUTHUA, S.W.: Challenges and outcome of management of post-traumatic TMJ ankylosis in children and Adolescents in Kenya. International Association of Oral and Maxillofacial Surgery course, October 2<sup>nd</sup>, 2009.
- AKAMA, M and GUTHUA, S.W.: Management of TMJ Ankylosis in children. International AOCMF Symposium on Advances in Maxillofacial Trauma and Reconstruction. Nairobi, Kenya. 30<sup>th</sup> October, 2015.
- BUTT, F. and GUTHUA SW.: Preliminary Outcome of the Management of Unilateral and Bilateral Craniomandibular Ankylosis. 10<sup>th</sup> Annual Surgical Symposium. The Nairobi Hospital, September 24<sup>th</sup>, 2016.