***Maxillofacial Trauma***

***Trauma in the head and neck area:***Trauma is a major thing; we see it in the dental clinic, it can be on a Dentoalveolar level (smaller level),and on a pan-facial level (bigger level).

Statistics wise the most common type of trauma seen in dental clinics is dentition related; the 2nd most common is dentoalveolar trauma, after that bigger traumas are less and less common which is something fortunate, this is because the whole build-up of the buttresses of the face makes it resistant to trauma (except when vector/force is too high, where the severity of the trauma is high).

The problem with trauma is that it is not that hard to discover its presence; it comes with the history of the patient, the biggest diagnostic dilemma is to realize the site and extent of all the fractures present and to look for signs of acute danger related to that trauma.

Looking for signs of acute danger is done by checking the air way and looking for intracranial and spinal injuries, etc., those are big/important clinical components but the radiographic component is just as important.

Fracture lines (which are just like any other bony structure in the body) are not immune to super impositions and artefacts seen in 2D radiographs. So if we are following the regular protocol of a 2D radiograph we must observe artefacts, anatomy and super impositions. To rule out everything... a clinical examination can be a good start in addition to taking another radiograph (whether 2D or3D radiograph).

So a single x-ray is not enough for the diagnosis of a fracture, to diagnose it we need at least 2 projections cuz if the x-ray didn’t go into the fracture in a 90 degree we’ll not be able to see it, so we’ll increase the chance of seeing something by taking more than one projection

like any other disease seen in the clinic, we have all sorts of options; we start with the basic radiographs(2D radiographs; simple PA, occlusal, panoramic, PA skull, lateral skull, Water’s view, town’s view, lateral obliques, SMVs, TMJ dedicated imaging, etc.)

Every hospital or any medical institute has a trauma protocol which can guide the clinician to diagnose and manage a trauma patient if the clinician is suspicious of any fractures associated with a trauma. We will address them from the simplest to the most complex traumas.

-if a line extends beyond the bone its an artefact not a fracture so we need to make sure first it’s a fracture cuz there will be some management for the area that can also be surgical management…so we take another x-ray to show us the fracture line…we should follow the cortical boundaries that need to be continuous for ex. In a “condyler neck fracture”---line-gap-line…what’s going to be bad about this fracture is the displacement of the condyle either laterally toward the ptyregoid or mesially to the upper fibrous and this can be seen in a panorama but ant and post displacement can’t be seen in the panorama
 **We will start with simple teeth related traumas (dentoalveolar trauma):**

***Concussion (dentoalveolar; in teeth)***

* The simplest type of trauma
* Bump with no loosening “crush injury”
* May not see any radiographic signs, because it’s a biological effect not a physical effect especially acute concussion of teeth
* It can be seen radiographically only after 3-4 months of concussion and radiographic signs appear (such as resorption and PA lesions) and the tooth is non-vital clinically
* Possible widening of the PDL space...(the chronic type)
* Tooth might be sensitive to touch or bite

When the tooth moves (even for a bit) after trauma, the trauma is called luxation

***Luxation is categorized into: “depending into the direction of displacement”***

1. Lateral luxation
2. Intrusion
3. Extrusion

We might’ve taken in other classes that luxation can be:

1. Luxation
2. Subluxation
3. Avulsion

Logically speaking all of those are just luxations with different degrees of severity and displacement of teeth from their sockets, so in radiology it is better to use the 1st classification.

***Intrusion:***

* Forced into the socket
* Lack of PDL space
* If severe enough, discrepancy of the occlusal plane can be seen clinically
* A PA radiograph would be very helpful for these traumas especially if it is not completely clear to differentiate between complete intrusion and avulsion

***Sometimes things are so subtle; for example when luxation and lateral displacement are accompanied by fracture of the buccal bony plate, no matter how many PA radiographs are taken, one can never detect anything due to superimposition, and upon vitality testing a false negative result will be obtained because it is acute trauma, it will only be revealed on clinical follow up after the tooth becomes non-vital and becomes in need of endodontic treatment;so if you have a clinical suspicion of a fracture, a 3D radiograph is a good choice even for a small dentoalveolar trauma, they (3D radiographs) are not reserved only for big pan facial traumas.***

***Extrusion:***

* Partial displacement out of the socket
* Widening of the PDL space

***Subluxation:***

* Loosening without displacement
* Sensitive to touch or bite
* The tooth is still in its socket

***Alveolar bone fractures:***Alveolar bone fractures are very important because in surgery they change the splinting protocol; we splint for far longer when we have an alveolar bone fracture as compared to an isolated root fracture, so the management for each is different.

In root fractures the fracture line will stop at the PDL space level, while if it is an alveolar bone fracture the fracture line will go beyond that and extend all the way.

Basically what we need to do here is look for the fracture line.

* Most common in the mandible
* In young males (16-35) on weekends

 ***Maxillofacial injuries***

***Mandibular fractures:***

Are usually associated with other fractures

The 2nd most common maxillofacial fractures after nose fracture and the most common ones we deal with as dentists.

***General approach for analysis and evaluation of any suspected radiograph of a fracture (4 S method):***

* Symmetry
* Sharpness (of the cortices)
* Sinus and any fluid level in the sinuses
* Any presence of a Soft tissue mass (because traumas are accompanied by hematomas and soft tissue oedemas)

-all of these are radiographic adjunct to the main clinical examination but radio graphs help us to locate the fracture and wither there’s displacement or not or if there’s oral communication “the difference btw simple and compound fractures”

Just like we look at those in the mandible, we look at them in the mid face and fractures of the nasal bone, etc. we compare the left side with the right side (sinuses with typical air levels and post. walls, bones, etc.) Dr Abeer talked about a radiograph with a fracture in the sinus there seems to be a swelling on the right side of the patients face, there is a problem in the nasal bone (fracture)

Fractures of the nasal bone are hard to detect &are the most common site of fracture in the maxillofacial area so they need a very good clinical examination in addition to good radiographic interpretation.

This serves as a prototype of all the other types of fractures,this does not only apply to the mandible, it applies to other bones as well.

***The difference between a simple fracture and a compound fracture:***

***Simple fractures***

* There is no skin involvement
* No antibiotics are needed

***Compound fractures:***

* There is skin involvement (exposure of skin barrier is seen)
* Communication with the outside environment (not only the outside atmosphere, communication with the PDL is an outside communication and the tooth also)
* Antibiotics are needed
* Seen in teeth fractures (any fracture involving a tooth is a compound fracture, this is significant for the management of the trauma where special instructions and antibiotics need to be given in this case (to reduce the risk of osteomyelitis for example))

Indirectly related to those (simple and compound fractures) are displaced and un-displaced fractures; we usually need to think about the muscles attached to that individual bone because the muscle pull will either help stabilize the fracture line or separate/displace it, making it worse.

***\* Displaced fractures🡪Bones do not stay in their position; they are separated***

***\* Un-displaced fractures🡪Bones stay in their position; with no separation***

**Simple and compound fractures can also be single line or comminuted:**

***Single fractures***🡪 only one line of fracture giving 2 pieces of bone, management is only reduction

***Comminuted fractures***🡪 multiple small pieces of bone, management includes reduction and replacement of soft tissues as well (making management reduction and reconstruction), its considered as the hardest one for repair

***Greenstick fractures***🡪 Periosteum is still intact and the two pieces of bone remain attached somehow, seen in young individuals because their bones are still elastic and capable of minor bending /bowing

**A fracture line can present as:**

A Radiolucent line🡪 Separation of bone by muscle pull

A Radiopaque line 🡪 Overlap of bone due to approximation by muscle pull,telescoping(muscles pull the 2 pieces of bone together) or it could create a Step like defect/step deformity (when the bones are pulled toward each other with an angle”
sometimes you might be able to see all those types of fractures in the same ptn

Step like deformities can be seen on cortical bone level and on an occlusal level (where occlusal discrepancies are one of the most important signs to look at to detect fractures).

If you encounter a patient with clinical signs and history of a mandibular fracture you start with:

* A panoramic radiograph 🡪Scout view, the most widely used, the most versatile, the lowest dose, it is good as a baseline
* Then go for an occlusal view 🡪right angle view, because it gives a different angle
* Then a CT scan 🡪 for extensive injuries

The first 2 are used when we suspect an isolated mandibular fracture without any clinical signs or suspicions of a midface trauma. If the midface is involved we must always use 3D imaging because the midface is an area filled with small, thin fragile bones that are surrounded by many vital structures with a high degree of overlapping where 2D radiographs can’t be of much help for diagnosis and detection of fractures.

**To be concise Observe:**

* Multiple views
* Continuity of Cortical margins
* Any discontinuity of the mandibular canal
* Make sure that there is no pathology (to determine if it’s a pathological fracture or a traumatic fracture)
* Clear out that there is no superimposition in the symphyseal area (by taking another view of the same area; that is the main reason why we take an occlusal radiograph)

\* If a 3D image is obtained, one would have all the needed information ...i choose it from the begging if i believed that the fracture is extensive and not a simple one like mid face fracture...etc

In pathological fractures there is no sharp line of fracture, a frank pathology is exhibited and there is thinning of the cortices, bone is eaten off with central pathology within the bone marrow, where a fracture will occur when the bone becomes thin enough (similar to the idea of cavitation of a class 2 carious lesion due to undermined enamel).

In 3D radiographs we look for fractures and their extent, any associated other fractures in other bones in addition to proximity to vital structures; a treatment plan, virtual surgeries and fixation are done on the 3D electronic model.

If you think it is bigger than the body of the mandible then you probably need a 3rdman vision

We need to think like clinicians; evaluate and look for deviation (to the affected side on opening), inability to protrude, altered mouth opening, open bite, ecchymosis, oedema, pain, trismus, etc. (basically everything we were taught in surgery).

Non-displaced fractures are the subtle fractures which we need to look for carefully.The only thing that can tell us about their presence is history and fracture line in the 3D image and paraesthesia if the mandibular canal is involved in the fracture line.

To know if a bone is displaced and where is it displaced you should performa proper clinical exam to make sure that there are no other vectors in the trauma which influenced the position of the fracture or take another radiograph.

\* Condylar neck fractures are more common than condylar head fractures

\* Teeth in line of fracture should be removed and an antibiotic prophylaxis should be given to the patient.

***The Maxillofacial skeleton is made of 4 components***:

1. Frontonasal bone
2. Zygomas
3. Maxilla
4. Mandible

***The Mandible:***

* Is the 2ndmost common site of fracture in the skeleton
* It is a single bone
* Relatively isolated when compared to the other bones of the skeleton
* Faraway from vital structures
* Muscle attachments are simple and their pull is quite predictable
* If it is affected, other bones and structures are not affected while if higher bones are affected other structures will most probably be affected too with complications (spaces, air way, sinuses, etc.).

As always we look for location, presence and extent of fracture and these will be the first line of investigation (baseline evaluation); if higher bones are also affected a higher level of evaluation is needed where we look for airway constrictions, life threatening impingement on the spinal cord, cervical spine injuries, intracranial injuries, etc.

Panoramic radiograph have the physics of superimposition,but the CBCT is very sharp

Pliers of maxillofacial fractures : fronto-nasal, zygoma, maxilla,mandible and u have to go and evaluate these 4 important components individually to make sure there’s no discontinuity in these components “like in mid face trauma” but most importantly we need to check the airways that could be threatening and the brain “intra cranial trauma” so we should think of the ptn health 1st...we should think ABC , is the airway intact or is there any intracranial injury after that we can go to maxillofacial stuff and make sure that the ptn is stable

***Some of the tools used for higher level of evaluation include:***

* MRI
* CT
* CBCT

***An MRIis used for soft tissue analysis and evaluation, and by priority you should start with:***

1. The brain: to make sure there is no intracranial haemorrhage.
2. Then the eyes/orbits where they are as important to the brain but come 2nd in line; to make sure that the patient is going to live before determining anything else such as orbital haemorrhages, retinal detachments, any foreign bodies in the orbits, etc.
3. Then everything else.

Then you need a CT or CBCT depending on what type of hospital you are in and the available facilities.

Abnormal air fluid level is actually unique because it is found in spaces; surface tension of fluid level can be seen in the sinuses (like a glass filled with water) and the fluid that fills the sinus after trauma is blood.

Nasal fractures are common and if you take a soft/underexposed lateral skull radiograph to view the soft tissues and concentrate on the nose would be very helpful to detect those fractures.

It is very important not to confuse fracture lines with the normal skeletal sutures(naso-ethmoid suture when looking for a nasal bone fracture for example).

A suture is a site where 2 or more bones meet and fuse after completion of growth.

Know the difference between an axial view and an occlusal view!

***Zygomatic complex fracture:***

* Was named a tripod fracture but nowadays this name is not used anymore because they determined that its shape is way too complicated, it is not just desostosis of the sutures surrounding the bone its the 3rd most common facial fracture
* You might be able to palpate the depression
* Flattening of the cheek (because Zygoma is the cheek bone, its detachment will cause flattening)
* limited mouth opening (because the Zygomatic arch will impinge on the coronoid process, preventing complete opening of the mandible)
* Haemorrhage into the eye so we really need to worry about the orbit
* Peri-orbital bruising
* Nose bleeds if the sinus was filled with blood to the mid osteum
* Fracture is at the level of:
	+ The lateral orbit at the zygomatico-frontal suture
	+ between the Zygoma and maxilla;zygomatico-maxillary suture
	+ zygomatic arch and temporal bone on the zygomatico-temporal suture

That is why it was called a tripod fracture

Radiographs needed:

* Waters’ view to see the fluid level of the sinus and if theres any displacement in the zygomatic level
* Underexposed/soft Sub-mentovertix (SMV) to view the Zygomatic arch
* CT scan🡪to answer any questions about orbital content, orbital movement and orbital floor suspected trauma

A CT is the radiograph of choice for all midface traumas and the diagnosis of these fractures is not that much of a problem; the treatment is a really big problem though.

In an isolated Zygomatic arch fracture, the arch will be split to 2 pieces and is depressed all the way down. It is managed by a tool called an abvigazer which can be inserted from above the arch or through a scar(either old or new).You don’t even have to stabilize the fracture because it is an arch, so if there isn’t loss of structure you just use this tool to snap the arch back into its form.

Le Fort is a French anatomist who smashed a huge number of human skulls into the floor to determine the incidence, prevalence and distribution of the fractures that occur in the midface, and to also determine the most susceptible areas of the midface to fractureand eventually came up with a classification for those fractures depending on the horizontal level of the fracture.

In Le Fortclassification it is hard to completely fit into one category:

***Le Fort I:***

* Least severe fractures of the midface
* Isolated maxillary
* Not involving the lateral pterygoid plates

***Le Fort II:***

* A bit more severe
* Orbital floor and the zygomatico-maxillary suture are more involved

***Le Fort III:***

* Facial depression
* Very high fracture line
* Facial dysostosis; the zygomatico-frontal suture is being dysostosed, the fracture line is all the way/high up, involving the whole midface

All of this is just statistics; you can hardly find patients which purely fit into Le Fort I, Le Fort II or Le Fort III classification, a combination of those can be found because trauma is quite variable and depends on the cause and on the traumatized individual.

You need 3D radiographs for sure in these fractures because vital structures are almost always included in those fractures.