**Developmental anomalies.**

Most of those anomalies are not strictly radiographic in nature, they have major clinical signs and symptoms, even the patient knows that something is happening and they are presenting with that clinical abnormality and all you have to do is **confirm** from history and radiographic appearance.

Some important definitions:

Anomaly: inconsistency or deviation from normal. Doesn’t always need to be an active disease process that need to be treated, they might affect your treatment plan.

Congenital: a condition that presents at birth, could be hereditary or environmental but the idea is that the patient was born with it.

Acquired: a condition that develops after birth.

Now we’ll be classifying developmental anomalies into dental and non-dental.

Dental anomalies:

-they might affect number, size, location of eruption and shape of the teeth.

***1-number:***

Hyper- (too many) or hypo-, oligo- (too little) dontia.

Radiology is important here and comes in handy for localization, like the exact BL coordination of a supernumerary tooth, or the correlation of it to the surrounding teeth or structures (i.e. if it causing resorption to a tooth, affecting bone, approximating vital structures), thus it’s mostly for treatment planning, that I know it’s there but I wanna know where exactly is it and how the surgeon would approach it. And also to determine if any pathology is associated with an impacted structure, i.e. dentigerous cyst. This is generally the role of radiology.

**-Hyperdontia:**

If you see too many impacted extra teeth you should start thinking about the two syndromes; Gardner’s (which is more serious due to intestinal polyps that will 100% transform into cancer “colorectal carcinoma” They need to consult a GI specialist) and cliedocranial dysplasia (absent clavicle, skull deformations and other features that will be discussed later on in this lecture)

-a radiograph that shows an extra tooth and you need to pay extra attention to figure it out because it was a third premolar that is fully erupted and well aligned.

-some of supernumeraries are only seen in special types of x-ray imaging and they become important when a problem comes. i.e. most common cause of lack of eruption of a central incisor is mesodense, so when one central is erupted and 6 months passed without the eruption of the contralateral one radiographs are taken to exactly know the reason.

-a radiograph (CBCT) showing an axial cut (axial cut goes from up to down), and images of three cuts that corresponds to the three green lines on the axial cut (cross sectional because they go 90 degrees along the arch), and a reconstructive panoramic image out of the CBCT volume.

- panoramic images are the best 2D imaging when it comes to superimposition because the machine moves around the head and the receptor translates as well, engineers make it in a way that anatomy features -within the focal trough of the machine- are clear and if are outside of that area they look blurred, which is good generally because we care about mandible and maxilla not the details of the cranial base. Sometimes if you have a small supernumerary that is way too lingually or palatally impacted, it’s hard to be seen on a panoramic radiograph so it (focal trough) might be considered one of the flaws of panoramic imaging as well.

**-hypodontia:**

-sometimes primary teeth might not have even the buds of successors, or after extraction of primary lately you’ll have no permanent successors eruption. Both conditions describe the presentation of hypodontia and in both cases you might consider further investigations.

-teeth common to be missing: third molar. Lateral incisors, lower second premolar. If these teeth are absent you shouldn’t directly think of syndromes as they are common to be missed. But when more teeth are involved, more than 6 teeth (oligodontia) now you should start thinking about something else. Anodontia : no teeth, the doctor showed a panoramic x-ray for 5-year old kid who has anodontia.

-one of syndromes that causes hypodontia is ectodermal dysplasia. Affect all body tissues that are derived from the ectoderm (features like dry skin, scanty hair, few missing teeth…). It’s a group/spectrum of diseases with different types, multiple variations and genetic evolution of each. they might look closer to normal or be too severe.

From a dental perspective, patients of ectodermal dysplasia enter a long term care and a complicated dental approach. They present early when they are young. The best prosthetic option for these young patients are removable appliances that they change regularly according to the age and growth spurt. Fixed prosthesis will restrict growth so are not planned until 18. Implants = fixed prosthesis, but these patients don’t even have bone, not because the disease affects bone (bone is derived from mesoderm) but it’s some kind of atrophy, so they get into major grafting procedures then receive implant therapy. SO, seeing an image with hypodontia might be the beginning of the story.

 ***2-size:***

Macro- and micro- dontia

-can be seen clinically not just by radiographs.

-3rd molars and lateral incisors are the commonest to have size variations.

-these are considered anomalies and as we said not every anomaly is an active disease. A patient might be happy with his peg shaped laterals for example, then you should do nothing about it.

-might be localized or generalized, and the differential diagnosis for each is totally different.

**-macrodontia:**

-true macrodontia: when teeth are really larger than their normal size.

- Sometimes comes with vascular abnormalities (hemangioma: hypervascularised area of head and neck which means an accelerated follicle development so a little bit larger teeth result.), hemi-hypertrophy of the face or gigantism (high levels of GH).

-large teeth would create an array of dental problems, the hardest are esthetic problems in anterior teeth, like in cases of fusion and germination they’re really hard to be esthetically treated. But in posterior teeth they might be treated by orthodontic measures.

**-microdontia:**

-we said that vascularization means nourishment and they affect the size of follicle thus teeth, also hormone levels do, so decrease of these will give smaller teeth (microdontia).

i.e. congenital heart disease, nutrition problems (vit. deficiencies), down syndrome (so much anomalies are related to down syndrome but none are specific or pathognomonic for down syndrome)

-relative microdontia: when the jaw is big so the teeth appear small. So radiographs are not enough, cephalometric analysis might be needed and clinical inspection is so important.

-the hallmark is open contact everywhere.

-sometimes technicians might give me the false feeling of small teeth when creating positioning errors. i.e. when the patient is positioned too far anterior to the machine.

-usually supernumeraries tend to be smaller when are not supplementals (is a supernumerary that resembles size and shape of a tooth).

-very early on chemo-radiotherapy results in catastrophic effects on teeth, but this is a very rare incidence because unfortunately such patients who had sarcomas once usually pass away and you won’t get to see them later on in life so if it happens and you see small teeth and no roots then it tells you a good story of a survivor, fma elak dkhal.

***3-location:***

-Impaction: when a tooth is cased in bone or soft tissue.

-transposition: when teeth switch places.

-ankylosis: tooth fused to bone.

-ectopia: it’s a general term. When a tooth is not where it should be, used frequently with canines.

-**impaction:**

-on a radiograph, if one of the typical teeth that should be present is missing then it’s either missing congenitally or is impacted. Usually you have to run statistics in your mind, i.e. if it’s a canine and not present clinically it’s mostly impacted, while if it’s a lateral it is more common to be missing. Radiographs here determine location and the path of surgical approach, especially if these impacted teeth are adjacent to vital structures like ID canal or maxillary sinus. And can be used (radiographs) to determine any type of pathology that might affect surrounding structures like cystic degeneration, tumors or resorption of the adjacent tooth.

-sometimes they are easy to be seen sometimes they are not, like in the previous example of the panoramic x-ray (ta3 el focal trough). Another image of a fully dilacerated crown of an impacted lateral.

She presented a lot of radiographs, described how each section was taken and what technique has been used for each. unfortunately, we don’t have them.

CBCT imaging gives you 4\*4 cm more field view to focus on the region of interest that you are looking into and to give better resolution.

A CBCT of a tooth that is within the arch, NOT too buccal or too lingual to affect the cortex to make higher contrast so you can see it in other type of images. This impacted tooth should be extracted if it was causing any type of pathology either radiographically or clinically; communication with the oral cavity, pain, infection, affect adjacent structures… also, the decision of extraction depends also on the treatment planned, I.e. the patient wants implant.

**-ankylosis:**

-it’s where the radiologist doesn’t have a big role.

-when you tap on an ankylosed tooth it gives you a metallic sound.

-clinical signs and symptoms are far more accurate and specific.

-ankylosed tooth doesn’t mean that the bone and the tooth become one block, sometimes it’s the situation but in most cases, thinking about the root in a 3D manner, if ankylosis is on one side/root/surface then the tooth becomes ankylosed but when you take x-ray for the tooth if the beam wasn’t 90 degrees on that surface, we won’t be able to see the lack of periodontal ligament space or the thicker lamina dura. So, on radiograph, if you see ankylosis then that’s nice, but if you don’t that doesn’t mean there is no ankylosis, you can rule it in not out.

i.e. a patient presented with retained primary, infraocclusion, history of extraction failure, here radiographs will prove nothing, it is proven clinically.

***4-morphology:***

-fusion: when 2 teeth become one.

-gemination: one tooth(bud) becomes 2.

-Concrescence: fusion of cementum. It’s NOT ankylosis.

-taurodontism: when the trunk of pulp canals become wide and horns become highly reaching and roots are short, the tooth look like a taurus.

-dilaceration: curvature of the root of the tooth, usually induced by trauma.

-dense in dente: when an enamel organ invades inward (invagination) or outward (evagination).

-fusion and germination can be differentiated by number of teeth. If we’re missing one tooth it’s fusion. Sometimes we can differentiate by the number of roots on a radiograph (two roots one crown then fusion for example), but these are anomalies and have variations

-Whether its gemination or fusion, its an esthetic dentist nightmare. Cause you have a large central, and there is not much you can do about it. At the end they will redistribute the space, by doing mock up ending with a larger canine and lateral, and smaller geminated central.

-If you are going to do endo for such a tooth, it will be really interesting! This is challenging.

-Dentists may decide to move to an easier way by removing that tooth and put an implant. It gives a better esthetic outcome.

-We can't tell what's right and what's wrong. We always have differences in treatment planning between drs.

-A case for ex.

A 50 yr old male, with grade 3 mobility for his upper teeth (which we always think of extraction for such a case). But in this case they have opened a flap and did a v.nice perio. Then they put brackets and intrusion to the teeth. Teeth was moved from grade 3 to grade 2 mobility.

The patient was very cooperative, after 5 yr follow up his gingiva was really clean.

They inserted multiple implants and bridges. So they preserve his teeth!

Its not easy to find such a patient.

-(People have been putting implants for enough years. And now the complications have been established. It doesnt mean we will stop doing implants, because it's one of the best things that happened in dentistry, and patients were really happy with it.)

مو متاكده ليش انحكت هالجمله

يمكن قصدها انه patients will prefer to do implants rather than multiple follow ups to preserve their grade 3 mobility teeth!

some pictures were viewed :

-Gemination :is twinning and complete division (2 teeth).. We may think that it's a peg shaped lateral and a supernumerary tooth. But statistically this is most probably gemination. it depends on how you look at it, but in the end you have 2 tiny teeth in the front area of the mouth, and you have to fix it esthetically.

-Fusion: 2 teeth fused. You will have two roots at certain areas, but sometimes things will be a little bit tricky.

-concrescence: teeth that are fused by cementum. This is not an easy radiographic finding, because -like ankylosis- concrescence is not a big chunk of cementum, it could be alittle area between 8 and 7 for ex.

The problem here is that when you are trying to extract the 8 and the 7 go out with it!!

-Hypercementosis may come with some other diseases like paget's disease, periapical cementosis dysplasia, and hyper- and hypofunction.

So if you have impacted 8 and idiopathic failure of eruption for the 7, this will be a risk area that might have concrescence more than your typical normal patient.

-taurodontism:the only time when it comes a problem, if we have to do endo for such a tooth. Cause its a large pulp with small roots, and sometimes apices will be open.

In the book you will see that its sometimes seen with down syndrome patients, but its not specific to it. and many of your patients will have it.

They come in different variations.

-Dilaceration: trauma to a primary tooth will cause dilaceration to the permanent.

It's not preferable to do endo for such a tooth. extraction is also hard.

But as long as the tooth is healthy we don't have any problem.

-Dens in dente: it's another difficulty in endo

It's when Enamel organ goes inwards (tooth within a tooth, because we can see enamel opacity in the tooth)

Most of the cases that you will see will be a tiny enamel radio opaque like lining that goes inward. You might actually miss it in the radiograph if you did not look carefully.

Dens in dente can come in different sizes and shapes, its more impressive in some areas, and more suttle in other cases.

The problem is that the bottom of that infolding is thin,usually interrupted and its a highway to the pulp.

Evaginatus: mostly detected by clinical diagnosis.

Not that common in arab world, which is nice

It looks like an extra cuspid at the middle

The problem with it is that it will be exposed to attrition by occlusion. And they contain pulp horn.

-Enamel pearl: enamel extension apical to the CEJ, usually at the furcation area.

Usually there is no problem with it unless your patient have active periodontal disease , cause after treatment of active periodontal disease re epithelialization at this area will be hard (fibers cant attach to enamel)

So its one extra reason for your patient to take care of his teeth.

Talon cusp: extra cusp on a lateral incisor mainly, sometimes on a central.

It could be impressive and large (looks like an extra tooth). Called talon cause it looks like المخلب

It doesnt need any radiograph.

Its similar to evaginatus, but its bigger.

-Turner tooth: tooth that has local hypocalsified spot, due to infection or trauma in the primary tooth.

You may see pitting, ridging, hypocalsified area.

-Hutchinson's teeth: I don't think that any of us will see it. Which is nice

It's an effect of congenital syphilis.

Looks like screw and mulberry teeth.

 Centrals are narrower cervically and they flare up incisally .but in hutchinson's it will have the opposite angulations.

Mulberry means that we have small sub-developed cuspids (5,6 or 7 cusps)

-Amelogenesis imperfecta: hereditary defective enamel, have multiple subtypes:

Hypoplastic, hypomaturation, hypocalsification, hypomaturation/hypocalsification. [this is the simpest way of typing AI]

From a radiographic perspective:

1-Hypoplastic has a nice mineralized enamel but its thinner ( enamel is moreradio opaque than dentin but thinner)

2-Hypomaturation: the enamel layer has the right thickness, but less mineralized (the same colour as the dentin, the same mineralization), if you where lucky and you where able to take a radiograph while the enamel still in full thickness.

3-Hypocalsification is more severe than hypomaturation, usually you will see pitting, ridging, loss of surface enamel and more accentuated features.

4-Hypomaturation \hypocalsification :areas in between hypomaturation and hypocalsification.

These 4 types are important because it really differes in prognosis, treatments, and long term follow up.

\* even a thin layer of good enamel works better than a thick layer of hypomatured enamel.

The dr.showed a case where we were able to have a nice image for a hypomaturation, because the patient has anterior openbite, so we don't have occlusal forces on these teeth. Usually its not that nice, and usually it's difficult to tell that we have hypomaturation cause the patient will come at a late stage where he only has RR.

Hypocalsification at early presentation is actually more sever

-Dentinogenisis imperficta: its pathognomonic from a clinical and radiographic perspective, so its easy to diagnose.

It has 3 types:

With osteogenesis imperfecta

Without osteogenesis imperfecta

The Maryland type :which has a big pulp chamber instead of the obliterated pulp chamber.

\* here we only see types 1 and 2, and the only difference is whether we have OI or not.

If the pt have blue sclera, multiple fractures and scars then its type 1.

We have bulbous crowns, constricted necks (CEJ) and obliterated pulp chamber >>this only can be DI.

-Dentin dysplasia: have 2 types:

Radicular (type 1): takes out the whole roots, called rootless teeth. Its not the only disease that gives you rootless teeth, for ex.early childhood chemotherapy or radiotherapy give rootless teeth as well, if its generalized then both sides of the head are radiated.

Coronal (type 2): they have roots, but we have multiple pulp stones, and the roots have some sort of different morphology in the overall shape, open apices and sometimes presence of internal root resorption. Dentin is there but its defective, so we see apical areas with multiple radiolucencies, because alot of these teeth will turn non vital because of the defective dentin.

Regional odonto dysplasia: it affects all parts of the teeth enamel, dentin and cementum ( as the word ODONTO means) so the teeth will look like goast teeth.

Morphologically abnormal teeth in an abnormal situation, even there supporting function does not work as intended, and the pt will lose them really early.

I can barely see it on radiograph.

\*\*

-some definitions:

Hypertrophy: enlargement, increase in size

Hyperplasia: increase in number

Hypoplasia: incomplete development of tissue

\*\*

-Synostosis: abnormal fusion of bones, too early fusion or asymmetric fusion of sutures of the skull for ex.

Synostosis causes skull abnormality, like brachycephaly: where skull is short and broad, because the suture that runs anterio-posterior is restricted, while the suture that runs sideways is normally growing >>head is short and broad.

Another problem is oxycephaly: cone shape

trigonocephaly: triangular in shape.

These all are Combination of morphological abnormalities in the skull due to synostosis.

it is one of the really hard clinical situations.

[so synostosis and gemination are hard clinical situations ]

-Stafne: is just a little cave where salivary gland tissues set, you definitely dont wanna do biopsy or anything with it, and it has a very typical situation.

Stafne does not only affect the submandibular gland, sometimes you may see variation of it affecting sublingual salivary gland or parotid gland.

with a lesser percentages you may see it in other places (they could look weird). so if you see some weird radiolucency caved there in the ramus, we would need more imaging cause stafne wouldn't be the first thing that comes in to mind.

-Tori: may be in maxilla or mandible, you can see it in... (? I couldn't get the word here)

It may be discomfort if you're doing complete denture fot ex.

In US its an abnormal thing if u see a pt without torus!! But here its not that common. So its race related, some people try to relate it to occlusion forces, bruxism and parafunctional habits. but by evidence its more racial, genitic related.

-Condyle: you may have:

complete agenesis ( there's no condyle)

Hyperplasia

Bifid condyle: it's the only one that's just a variation of normal

\* agenesis and Hyperplasia could be congenital or environmental

-Cleft palate: congenital anomaly, there is different stages that we need to take radiographs for a patient with cleft palate:

The first one, before eruption of the canine, because at that time surgeons would be planning a graft, in order for the canine to find a place to erupt.

And then for ortho or surgical purposes you will need several cephalometric or even 3D imaging, especially if the pt had done several surgeries and this is a redo surgery.

So you take specific radiographs for specefic treatment on that age.

-Maxillary sinus: including many variations, like neumatization, Hyperplasia, agenesis, generalized bony problem, and sometimes is just a variation of normal

-Cleidocranial dysplasia: we know it

-We will talk about 2 syndromes :

1-crouzon syndrome is a craniofacial dysplasia, and the problem is in the midface and the skull,mandible is not affected

It involves frontal bossing(protrude and bulging), hypertelorisim (increased distance between eyes) and copper beaten appearance (these markings are done by the growing brain)

We know that many of these syndromes have problem in the sutures,they close at a wrong time, or in asymmetrical way, and in this case the brain is trying to become bigger but the skull limited it. And this leads to pressure at the inner table of the skull,depending on the gyri, that will do sth like finger print on the inner table of the skull to give this appearance (copper beaten appearance)

Any case with synostosis, or abnormal closure of the sutures, the brain will enlarge and give these marks, so we have manny syndromes with copper beaten appearance, the one that we care about, and the most common one that you may see in your life is crouzon syndrome

We will see Undeveloped midface, retruded maxilla, v.undeveloped zygoma (that's why you will have down slanting palpebral fissures), copper beaten appearance , the mandible looks like its larger but its not(the maxilla is smaller).

2- treacher collin called mandibulofacial, so the main problem is the mandible, we also have colobomas (iris have missing part, there's no complete fusion of the circle of the iris), clefts are very common

The angle and the shape of the mandible is completely abnormal,but the maxillary relation with the skull looks normal

It gets worse with the growth, because of the restricted growth of mandible.

**good luck :)**