Radiology

Sheet #11

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* **Skull views:**

Why do we need them?

-certain views show different structures, some structures are thicker, dense, or cortical; these will cover all the air filled or soft tissue areas in the radiograph.

The cranial base is dense at the temporal bone and thick at the mandibular septa so anything that is made up of thin facial bone or sinus or a condyle is definitely covered up by these dense objects. The whole idea is to send these objects away from the main direction of the central beam.

1. Water’s view:

Here we want to focus on the sinuses, so if we took the radiograph when the patient is upright the sinus will be superimposed, so they decided to change the geometry, so they left the patient’s head so the cranial base is not parallel to the sinus.

Water’s view is named after the scientist that made it up.

1. Reverse-Towne view:

Indicated for the condyle, condular head and condular neck fractures.

Here the patient should lower his head so the condyle is not parallel with the cranial base, and open his mouth to the maximum so the condyle is out of the glenoid fossa.

1. Submentovertix:

Mento: mental area. Vertix: the most superior part of the skull.

The radiograph here is taken from below; the film (receptor) is on the vertex area. The patient should left his head 90 degrees. Here all structures are superimposed except the most lateral, that’s why it is indicated for zygomatic arch fractures.

\*\*Not a single one of these radiographs is diagnostic by itself, these come in series, any hospital that still uses plain radiography has specific series, rest series, mandible series, and ankle series. And that’s the way it goes, there are specific protocols for radiography.

* In submentovertical, the receptor is in the back of the skull, and the head is positioned in 90 degree manner, so it is indicated for the lateral objects of the head: zygomatic arch, the body of mandible, base of the skull.

Contraindication: if the patient has any clinical problem in the cervical area of the spine. Any cervical instability this radiograph could cause paralysis.

* In water’s view: the patient lefts his head so the sinuses appear, it’s mainly a sinuses radiograph. It would look weird because it’s taken at an angle; we need to know the projection and what it’s indicated for. (Sinuses in water’s)
* Towne’s view: the patient’s head is tilted downward with his mouth open so the condylar heads are located inferior to the articular eminence.
* Posterioanterior projection:  
  this is different from the PA in the cephalostat, the skull views that are PA or lateral don’t have cephalostat because they are not taken repeatedly, we don’t do measurements here, these are taken in the ER, they are not standardized, they are taken in a rough assessment of some tumor. They differ in magnification because linear and angular measurements are not calculated here like in the cephalometric projections. This is for medical use, and the cephalometric is for dental and orthodontic use. These are basic radiographs they are done along with supplemental Towne’s or other projections.  
  You can also focus the radiograph on the base of the skull alone for example if there were multiple myelomas or on the mandible alone.
* Lateral oblique:   
  this is a really old technique, if a panoramic technique wasn’t available this would be used, the patient is asked to lean on one side to take a radiograph of that half of the body of the mandible. But now it is replaced by the panoramic.  
  the head is positioned obliquely. The nasal bone is really thin, so we must go really low in exposure in order to see it.
* Sequential imaging:   
  first we take history and examination, and an initial radiograph (panorama for ex.) something in the radiograph wasn’t right, for example in the sinus area, so you go for something more specified, here it is the Water’s projection. Now we can see the sinuses more clearly, so sometimes we go even further and we take a 3rd radiograph, mostly a 3D radiograph that would make everything clear.
* Trauma protocol:  
  for example a trauma to the teeth caused a tooth to break, and that broken piece was never found, the protocol is to take a radiograph to the lips (soft tissue) because the tooth could be embedded in the soft tissue.

Now, how do we differentiate in anatomy, in radiographs?

* A CT scan isn’t appropriate for dental imaging since it has high dose, limited availability and high cost.
* So they started thinking of a way to take 3d images but with a low dose, so they came up with a technique called **Cone Beam CT (CBCT).**
* It’s very simple and using ideas that are already present in radiology.
* It pyramid shaped beam, and it runs on a PC, with a regular X-ray source.
* CBCT hardware is actually a combination of:  
   1. Fluoroscopy: used in hospitals.  
   2. Software of computed tomography (CT).  
  3. And the backbone of a panoramic radiograph (it looks like a panoramic machine).

So it gives us a 3D image, where there is no superimposition, distortion, magnification, etc. and all structures are clear.

* It has solved so many problems.
* CBCT cuts:

1. A cut that goes from the highest spot in head to the lowest spot is axial. (You can view the head from the highest spot to the lowest).
2. A cut that goes from anterior to posterior is called coronal. (Cuts in reference to a crown).
3. A cut that goes from right to left and the other way is called sagittal.

* The doctor believes that 3D anatomy is much easier than 2D anatomy because in 2D anatomy you have to imagine the structures while in 3D anatomy if you know your skull anatomy you will know your radiographic anatomy.
* We will discuss more details about it in fifth year.

Now how does it work?

* The machine works like a panorama by rotating around the patient's head giving a pulsating or a continuous x-ray at the same time. While the machine is rotating it takes multiple bases images with each degree it goes, which means the machine is actually taking a 2D image for every part it passes by from different degrees and we end up with multiple number of bases 2D images. After the machine finishes taking the 2D images, these images will be collected by the software by means of numbers (each number means a specific color, so at first the machine takes 2D images, these images will be transformed to numbers by the software and then to colors). This rotation process continues until it fills the whole matrix in the computer because we are not looking for a 2D image, we are looking for 3D images.

It does what is called back projection image reconstruction; it is a piece of software that puts basis images together to form a 3D image. (It is math).

* As we said what is good about this machine is that it uses a panoramic backbone and a normal dental source so its beam is not collimated, it is cone shaped (pyramidal, wide open).
* It also has multiple field views: meaning that I can take an image of the entire face, or of the mandible and maxilla alone, or a part of the mandible or maxilla. In some small field views I can only take an image of 2 or 3 teeth so that it looks like a periapical radiograph but in 3D.
* So; large field views are used for orthosurgery type of applications. Medium field views are used for dentoalveolar exodontia, impacted teeth. Small field of views are used for endo in some certain cases.

What is the difference between the CBCT and the medical CT?

* The conventional CT uses a **fan beam.** What does that mean?

It means two things:

1. Bad thing: The fan beam is a beam that is between wide and thin when it takes the images it takes them slice per slice with every spin this means a higher dose since with every spin it gives a single dose.
2. Good thing: The beam is thin and the receptor in front of it is of the same size, so whatever comes out is mostly signal for two reasons; the first as we previously said as the size decreases scatter also decreases so there is barely any scatter. The second is that any scatter that may appear is passes either above or below the receptor since it’s a small receptor, so scatter doesn’t get detected. And as we know scatter affects contrast.

* In cone beam there is more scatter since the beam is not thin and everything is wide open. Also the receptor that faces the cone beam is large and detects everything that comes even scatter.
* In conventional CT 95% of it is signal and 5% is noise. While in CBCT 20% is signal and 80% is noise.

So where is the idea here? Now we have two very important terms: contrast and resolution. Contrast is important when we have two tissues with thin difference in their densities and we have to see the difference between them.

Radiology is a task derived procedure, us as dentists we look for things like caries, periapical diseases, tumors, resorption. All these are hard tissue problems and there is a difference between densities when it comes to tissues involving them.

Density becomes a problem when we are talking about a surgeon that wants to take a radiograph of the thyroid for instance.

* So contrast is not a problem when it comes to us as dentists, The problem is when we talk about resolution since we need to detect small structures and resolution is about detecting small structures. CBCT is waay better than CT in detecting small stuff.

As the pixel decreases in size the resolution increases and in CBCT the largest pixel in largest field of view is between 0.4-0.5. While in CT the smallest pixel is about 1 cm.

* So in CBCT we are talking about a superior resolution which is desired with less contrast which is ok.
* The most important thing about this procedure is the dose.

We compare the radiographic procedures to background radiation. The dose of CBCT is about 8 days of background radiation while in CT it is equal to 256 days.

That doesn’t make CT the devil but the idea is if CBCT does the trick why use a larger dose? When it comes to a soft tissue task CT is the answer.

* Implant dentistry: the doctor showed a case that looks perfect from one point of view but when another radiograph was taken for another reason the implant has perforated the sinus. This happens when the doctor gets too confidant and decide to skip the step of preoperative radiograph giving catastrophic results. So you can never get confidant in you clinic.
* Notes:

The doctor advised us to check this website:

[www.marcilan.com](http://www.marcilan.com)

The doctor showed some pictures that we don’t have and explained the structures in them.