Original Research Article

# Principles of panoramic radiography (orthopantography)

Arvind Takle[1*], Suresh Maru[2], Amol Karagir[3], Digvijay Ghodake[4], Nilofar Mujawar[5], Advait Takle[6]

[1]Professor, [2]Assistant Professor, [3,4,5,6]Resident, Department of Radio-Diagnosis, Bharati VIdyapeeth Deemed University Medical College, Sangli-416414, Maharashtra, INDIA.
**Email:** doctor.akt@gmail.com

**Abstract** Guidance for technician for proper radiography different factors affecting the quality and anatomy on x-ray and different film artifact.

**Keywords:** Radiation Source, Receptor Plane of Focus, TM Joint, Object Distortion, Slot Technique, Chin, Occlusal Plane, Camper Plane, Exposure, Artifacts.

***Address for Correspondence:**
Dr Arvind Takle, Department of Radio-Diagnosis, Bharati VIdyapeeth Deemed University Medical College, Sangli-416414, Maharashtra, INDIA.
**Email:** doctor.akt@gmail.com

Received Date: 12/08/2015 Revised Date: 28/09/2015 Accepted Date: 18/10/2015

| Access this article online | |
|---|---|
| Quick Response Code: | Website: www.statperson.com |
| | DOI: 24 October 2015 |

## INTRODUCTION

The radiation source (right) the image receptor holder (left) move in the clockwise direction around the skulls while image receptor (IR) itself moves in the opposite direction behind the secondary slotted diaphragm. The central ray falls upon the counter orbiting image receptor having first passed through the primary slotted diaphragm, then through vertical slot nearest the image receptor. The central ray is guided in an elliptical track over three pivotal points C, B, A, Like three vertical planes of rotation with flat bundle of rays. The shape of slice can be adapted according to the patients age, shape of jaws. It changes 9mm in anterior region & 20mm in the region of TM joint. Object distortion in OPG: object in front of plane not sharply depicted & are reduction size while objects behind the plane are also not sharp and expanded in size. The slot technique provides clear image but at the cost of higher radiation exposure. In short OPG is based on slot technique in that it is an elliptoid shaped zonography with varying depth of field.

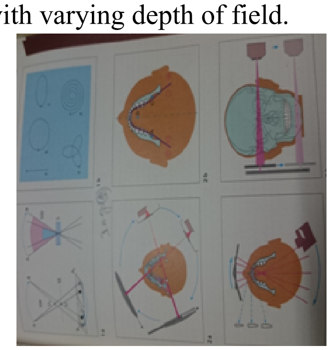

**Figure 1 a:** Principle of the tomographic technique

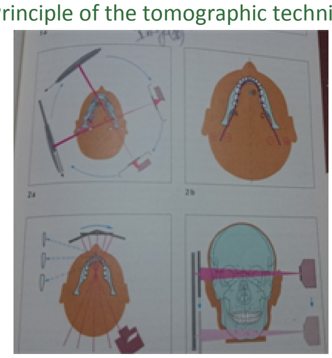

**Figure 1 b:** Attenuation methods for tomography

These diagrams illustrate the basis of linear attenuation (blurring): AB= path of the radiation source, A1/B1 = counter-orbiting path of the image receptor(film), SE= plane of the tomographic slice, SW = angle of the slice, U= desired detail in the targeted layer (black dot that will be in sharp focus), U1 = undesired detail outside the target layer (gray dot and blurred figure on the image receptor). This will be more or less completely attenuated depending upon its distance from the plane of focus. The thickness of the slice depends upon the selected slice angle. A small angle (short path, blue) will image a thicker plane than will a larger angle (longer path, red). If the layer in focus is thicker than 5 mm, the procedure is referred to as zonography, and if less than 3 mm, tomography. Fig. 1b Attenuation methods for tomography. a linear, b circular, c elliptical, d hypocycloidal and e spiral attenuation with contra-rotating image receptor motion. The method of spiral attenuation (with the longest pathway) provides the best results with the thinnest layers in focus and the least amount of volume artifacts, especially in skull radiographs. Fig. 2a Principle of panoramic radiography (orthopantography). The radiation source (right) and the image receptor holder (left) move in the clockwise direction around the skull, while the image receptor (IR) itself moves in the opposite direction behind the secondary slotted diaphragm. The central ray falls upon the counter-orbiting image receptor, having first passed through the primary slotted diaphragm, then through the vertical slot nearest the image receptor, According to the original version by Paatero, the central ray is guided in an elliptical track over three pivotal points from C over B after A. It would be better to think of these three pivotal points as three vertical axes of rotation within a flat bundle of rays. Fig. 2b Midline of the slice thickness. With modern radiographic equipment, the shape of the slice can be adapted (±) according to the patients age and shape of the jaws. The thickness changes from about 9 mm in the anterior region up to approximately 20 mm in the region of the temporomandibular joints. This imaging procedure can be categorized as zonography with different depths of field in different segments of the jaws. Structures outside of the plane are not completely eliminated, so that a summation effect from the third dimension may lead to improper interpretation of the two-dimensional radiographic image. Fig. 3a Object distortions in panoramic radiographs. In this example of the anterior region of the mandible, it becomes clear that objects in front of the plane are not sharply depicted and are reduced in size, while objects behind the plane are also not sharply depicted but are expanded in size. A metal sphere positioned in front of the plane of focus, for example during implant simulations, appears blurred and vertically oval in shape, while a metal sphere behind the plane appears blurred but laterally oval. Fig. 3b Principle of the slot- technique. Conventional skull radiographic techniques are associated with an inevitable pattern of scatter radiation. The slot-technique provides clearer images, but at the cost of higher radiation exposure. The skull can be effectively scanned vertically or horizontally with narrow, continuously applied "lines" of radiation, via focus-near (primary) diaphragms and secondary diaphragms slotted nearer the image receptor, the panoramic radiography described by Paatero is therefore actually based on the slot-technique, in that it is an eliptoid-shaped zonography with varying depths of field. In OPG radiographic quality, position matters lot & position of cha in anterior or posterior of midline change the appearance of film. There are various terminology used like bite plane, occlusal plane, habitual occlusion etc. incorrect positioning in anterior region of segment. This can lead to blurred depiction of the anterior teeth & width is exaggerated. Improperposition of skull and campus plane give different types of appearance.

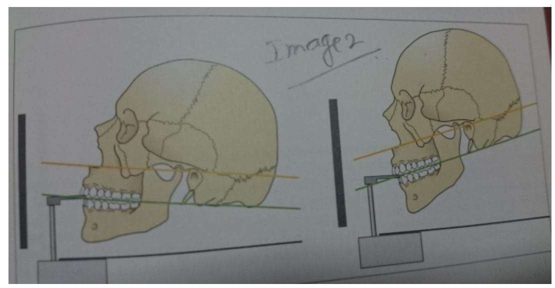


**Figure 2:** Improper positioning of the skull

The diagram shows the skull tilted posteriorly, which often occurs inadvertently during correction of the cephalostat upward in an already correctly positioned patient. In comparison to a horizontal plane, the occlusal plane and the Camper plane sink dorsally, and the result is superimpositioning onto the maxilla of the palate and the floor of the nose. Especially in children in the early mixed dentition stage, this type of improper positioning leads to overshadowing of the permanent tooth buds in the maxilla, and prevents their evaluation. Fig. 2Improper positioning of the skull. The diagram shows the skull tipped forward. Which is often caused by the lowering of the cephalostat in an already properly positioned patient. In comparison to the true horizontal (black), the occlusal plane (green) and the Camper plane ( yellow) tip upward dorsally. The proximal surfaces of the maxillary posterior teeth overlap and the temporomandibular joints are usually not completely depicted. On the other hand, using this approach, the apical regions of the roots and the nasopalatine space can be well observed. In the early mixed dentition stage, maxillary tooth buds can be more clearly depicted. When OPG is taken with mouth slightly open the condyles are projected free of any super imposition osseous structured & pathology & anatomy of TM joint is better appreciated.

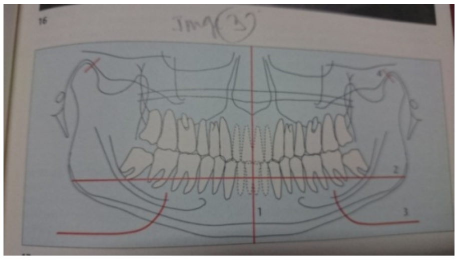

**Figure 3:**

Positioning in early childhood requires patience & it deviates from normal position for adults. The occulusal plane & also Camper plane should be position more steeply in order to permit clear vision of location of permanent tooth buds.

**Figure 4:** Positioning in early childhood

Taking a panoramic radiograph of a child will require patient positioning that deviates somewhat from the normal position for adults. The occlusal plane and child, it is prudent to position the vertical, lateral light guide at the level of the deciduous therewith also the Camper plane should be positioned somewhat more steeply, in order to permit clear vision of the location of the permanent tooth buds, i.e., to prevent superposition of the structures of the floor of the nose and the palatal roof. To insure a high quality radiograph, it is also important that the tongue position be correct, and this can only be achieved with children using appropriate patience! From the lateral viewpoint it must be kept in mind that the primordial of the permanent dentition lie high and behind the deciduous teeth. If the deciduous teeth are aligned in the focal plane, the permanent tooth buds, especially the anterior teeth, will appear enlarged and, depending upon distance from the focal plane, will appear more or less blurred and distorted. When taking a panoramic radiograph of a small canines.

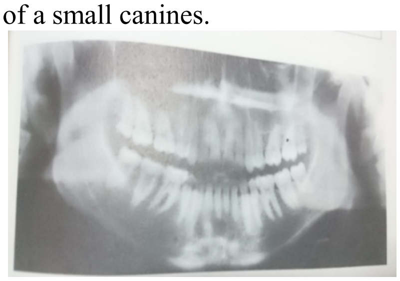

**Figure 5:** Panoramic radiograph-Tongue in proper position

The burnt out effect in radiography can be avoided if tongue is pressed firmly against the palate. It acts as radiation diminishing factors breath holding during expose causes effacement of structures of angle of mandible. Asymetric position arks with incomplete jaw closure resulting in aparent enlargement of the right side ramus, zygomatic bone  Improper positioning of median sagital plane also given errors

**Figure 6:** Asymmetric positioning errors

This panoramic view resulted from asymmetric positioning with incomplete jaw closure, resulting in apparent enlargement of the right side, ramus and zygo. matic bone, which are far lingual in the focal plane.  A visual left – to – right of both mandible and maxilla on this side appear enlarged and they overlap each other. The furcations of the right mandibular molars exhibit “enamel pearls” due to the overlapping. Foreign body within the central ray different types of artifact& affect quality of films. Jewellary, ear rings, nose rings r wires neck less, metal frames and eye glasses, metal zippers of dresses, improperly positioned protetive lead vest etc are.

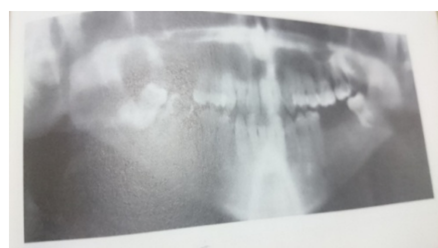

**Figure 7:** Foreign body within central ray

Motion artifact – if patient moves the mandible during exposure the radiograph will depicit like transverse facture of mandible

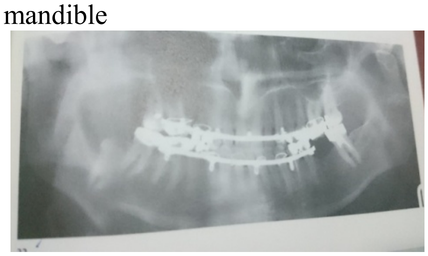

**Figure 8:** Movement during exposure

If the patient moves the mandible during exposure, the radiograph will depict what appears to be a transverse fracture of the mandible. Note here the depiction of tooth 48 and the "Step" on the right side, and compare this with the depiction of the deep collum fracture (left). If the patient moves the entire head during the exposure, artifacts and distortions will be visible within the entire picture, effecting both jaws and all vertically adjacent structures. If skull move horizontally during exposure a non diagnostic image will be the resuect & radiograth have to be retaken. breathing before exposure can lead it extremely air filled epipharynx can effect radiographic obliteration image 9 of osseous structures.

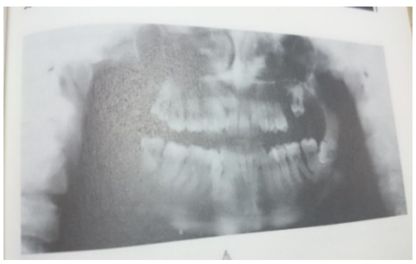

**Figure 9:** The influence of breathing on radiographic quality

Deep breathing before the exposure and breath hold during exposure can lead to extremely air filled epipharynx which can distort ascending mandibular rami and obliterate the osseous structures. Normal anatomy structures

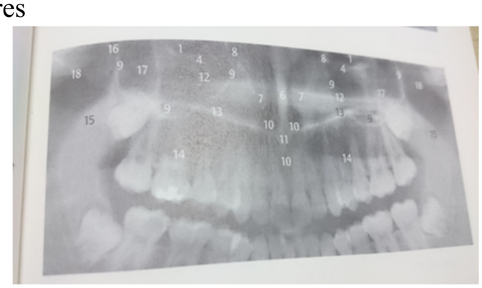

**Figure 10**

1. Orbit
2. Atlantooccipital articulation
3. Cheek, with nasolabial fold
4. Infraorbital canal
5. Compact basal bone of the opposing jaw
6. Nasal septum, with maxillary nasal ridge

1. Orbit
2. Cervical vertebrae with tooth axis
3. Basal compact bone of opposing jaw
4. Nasal septum
5. Inferior nasal concha
6. Maxillary sinus
7. Anterior nasal spine
8. Horizontal osseous palatal lamina
9. Laterobasal border of nasal cavity
10. Palatal velum
11. Pterygopalatal fossa
12. Body of zygomatic bone
13. Zygomatic arch
14. Basal compact bone
15. Mylohyoid line
16. Mandibular canal
17. Mental foramen
18. Digastric fovea
19. External ear
20. Mandibular articular process

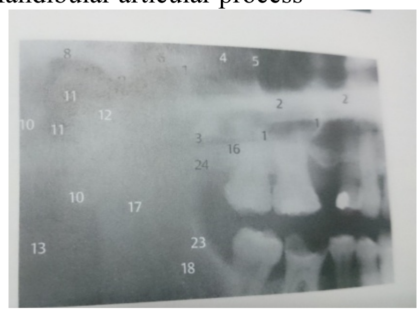

**Figure 12:**

Maxillary sinus

1. Shadowing due to horizontal lamina of palatine bone and laterobasal border of nasal cavity
2. Muscular (coronoid) process superimposed with the pterygoid process of sphenoid bone
3. Body of zygomatic bone
4. Innominate line
5. Zygomatic arch
6. Zygomaticotemporal suture
7. Glenoid fossa
8. Articular eminence
9. Soft tissue of external ear
10. Auditory meatus, with auditory canal
11. Articular process with mandibular condyle
12. Styloid process of temporal bone
13. Radiolucency caused by air containing epipharynx
14. Soft palate
15. Dorsum of tongue
16. Mandibular foramen
17. Mandibular canal
18. Anterior tubercle of atlas
19. Dens axis
20. Transverse foramen, axis
21. External oblique line
22. Temporal crest
23. Maxillary tuberosity
24. Pterygopalatine fossa

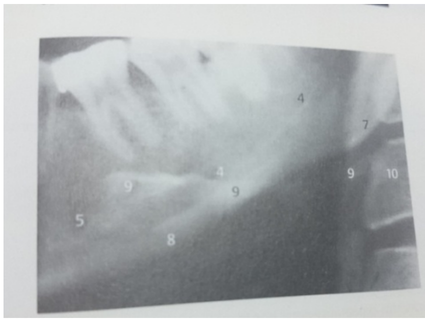

**Figure 13:**

1. External oblique line
2. Madibular crest with retromolar triangle
3. Mandibular foramen
4. Mandibular canal
5. Mental foramen
6. Angular process of masseteric tuberosity
7. Angle of mandible
8. Basal compact bone
9. Hyoid bone, with greater horn of hyoid bone
10. Cervical vertebra exhibiting clearly dense osseous plates on each vertebra
11. Maxillary sinus
12. Dorsum of tongue
13. Condyle(medial pole)
14. Condyle(lateral pole)
15. Muscular process in superimposition with pterygoid process
16. Neck of condyloid process of mandible
17. Soft palate
18. Radiopacity caused by roof of palate and floor of nasal sinus
19. Epipharynx
20. Long,ossified styloid process with its jointed connection
21. Radiopacity cause by compact bone of contralateral jaw

**Figure 14:** Panoramic radiograph of 9yrs old female

All permanent incisiors have erupted ,but their apical foramina, especially in maxilla, have not yet assumed the normal diameter, indicating incomplete maturation at this point. Age of denture Image 15

**Figure 15:** Panoramic radiograph of 20 yrs old female development of dentition is complete .apical foramnia

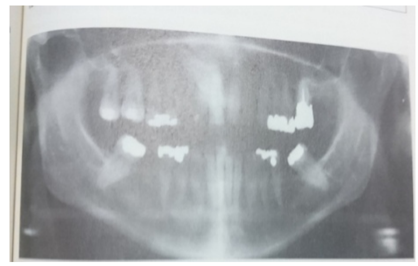

**Figure 16:** localization by changing the direction of central ray

Detcominalia of object localization in OPG. By changing the direction of central ray. An occlusal radiograph of maxilla which can only be taken with oblique projection because of anatomic constraints clearly reveals totally impacted tooth11, depicted axially in this projection

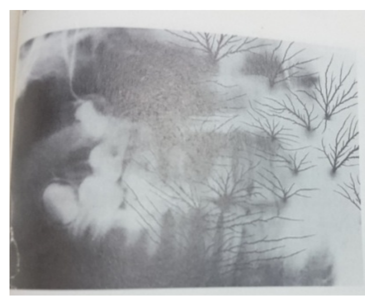

**Figure 17:** Contamination

Films artifacts which are now elimination CR system. Artifacts in form of "lightening bolts". such artifacts result if cassette film is removed too quickly from film pack, in low humidity.

**Figure 18:** Over exposed films.

Out of date cassette film-will exhibit clearly elevated background haze and produce final films with poor contrast.

## CONCLUSION

Proper understanding of Radiography and positioning of patient and setting of proper technical factor and elimination of artefact will produce good quality OPG film making easy for interpretation.

## REFERENCES


1. Perquin DA,Dorr PJ,Craen AJ,Helmerhorst FM.Routine use of hysterosalpingography prior to laparoscopy in the fertility workup;A multicenter randomized controlled trail.Hum Reprod 2006;21:1227-31.
2. Simpson Wl Beitia LG, Mester J. Hysterosalpingography:A reemerging study.Radiographics 2006;26:419-31
3. Nitin P Ghonge, Sanchita Dube. Hysterosalpingography:An obituary or a new beginning…?The Indian Journal Of Radiology & Imaging. 2008;18,175-178.


Source of Support: None Declared
Conflict of Interest: None Declared