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Featured Article:

Increasing the diagnostic role of the cephalometric attachment

Increasing the diagnostic role of the cephalometric attachment

By Dr. Allan G. Farman

Panoramic radiographic systems can be combined with a "ceph" attachment for performance of skull projections. A cephalostat is commonly used to standardize patient positioning for lateral cephalograms used in orthodontic assessment. What is not always remembered is that the cephalometric radiograph is simply a standardized skull film. Panoramic machines with "ceph" attachments can actually be used for producing a variety of plain films to evaluate the skull and jaws. In every case it is possible to use a 10 inch x 8 inch detector – usually indirect exposure x-ray film with screens within a cassette.

The aim of this communication is to briefly overview representative standard head film projection techniques and outline the key uses of each. It should be cautioned that while the cephalostat is valuable for the purpose of positioning the patient for orthodontic assessment, the head holder should preferably be removed or extended away from the head when making standard head films for other purposes. The shadow cast from this device may occasionally obscure diagnostic information.

Lateral skull projection

In the absence of signs and symptoms of disease, plain film extraoral radiographs are rarely selected except for cephalometric analysis for orthodontic purposes. The lateral cephalometric radiograph is made with a long source to midsagittal plane of 60 inches (approximately 212 cm) to minimize magnification distortion that would otherwise mean the tissues of the side of the head nearest the beam would be magnified much more than those closest to the detector, usually a film-screen combination in a cassette. In the US, it is a tradition to have the left side of the face closest to the detector – elsewhere the right side is sometimes chosen to be closest to the detector (Fig. 1). The detector is generally placed at a standard distance from the head, frequently 15 cm. The midsagittal plane is parallel to the cassette. The cassette is perpendicular to the beam with the central ray of the beam directed 2 cm above and 2 cm anterior to the external auditory meatus. The head is stabilized in a cephalostat with earrods and perhaps a pointer to the bridge of the nose. The natural head position is used with the mouth closed. To achieve this position a mirror in front of the patient can help. The patient is instructed to look straight into their eyes in the mirror.

The cephalometric radiograph is a special case of lateral skull radiograph (Fig. 2). Lateral skull radiographs, other than cephalograms, do not need specific source to detector distances, as precise measurements are usually unnecessary. Actually, leaving the cephalostat away from the patient's head might be desirable to prevent its shadow confusing the radiographic features (Fig. 3). Lateral skull radiographs can be used to evaluate possible

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fractures to the skull, jaws or cervical spine, to evaluate structural changes in the calvarium in systemic disease, or to evaluate suspected local pathological processes to the skull, jaws and pituitary fossa/sella turcica.

Posterior-Anterior (PA) projection

"PA" is frequently misused in dentistry to signify a periapical intraoral radiograph. Radiologically speaking, "PA" is restricted to posterior-anterior projections as opposed to "AP" or anterior-posterior projection. Conventionally, the point of entry of the x-ray beam is listed first and the exit point (that closest to the detector) is listed second. PAs are preferred to APs for dental purposes as the structures closest to the detector (film) are clearer due to less beam scatter and lower magnification distortion.

For the PA, the patient is positioned facing the detector with the tragus-canthal line parallel to the floor and the forehead and nose touching the cassette (Fig. 4). The x-ray beam is perpendicular to the detector and parallel to the midsagittal plane. The beam enters at the center of the external occipital protruberance and exits at the bridge of the nose.

Indications for the PA skull projection include orthodontic evaluation of jaw asymmetry, detection of fractures or foreign bodies following trauma, evaluation of structural changes in the calvarium in systemic disease, or evaluation of suspected local pathological processes to the skull and jaws (Fig. 5 & 6). It may be used in combination with the lateral skull radiograph to assist in localization of structures or foreign bodies.

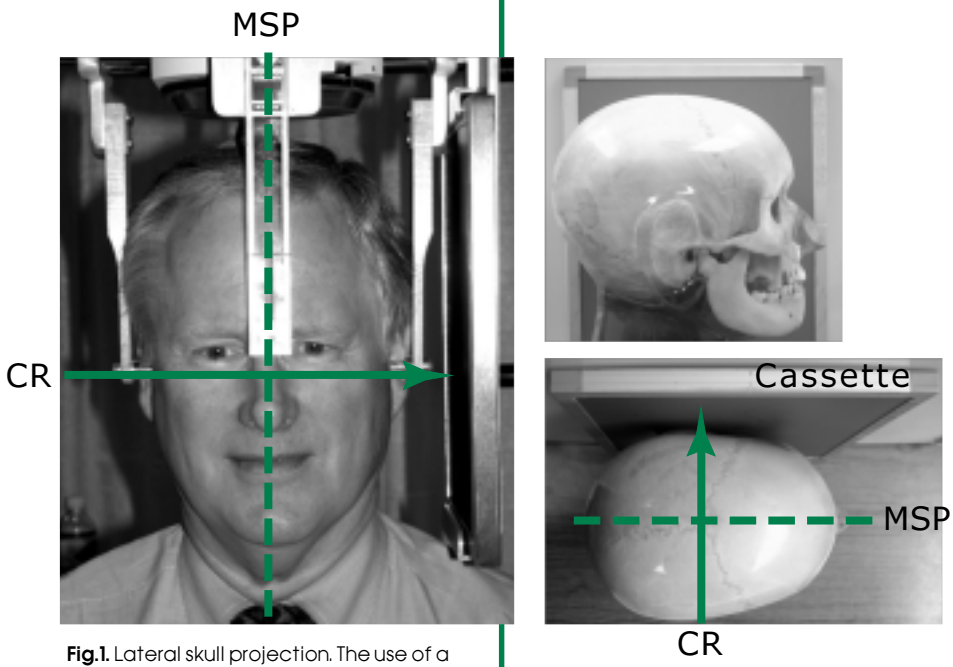

Fig.1. Lateral skull projection. The use of a cephalostat makes the radiographic image a cephalogram suitable for orthodontic analysis. CR = central ray; MSP = midsagittal plane. The left side of the face is towards the cassette.

Fig. 2. Lateral cephalogram of a patient with cherubism. Note that the multilocular radiolucency of mandibular ramus (arrows) spares the mandibular condyle. Unerupted molar teeth are displaced forwards.

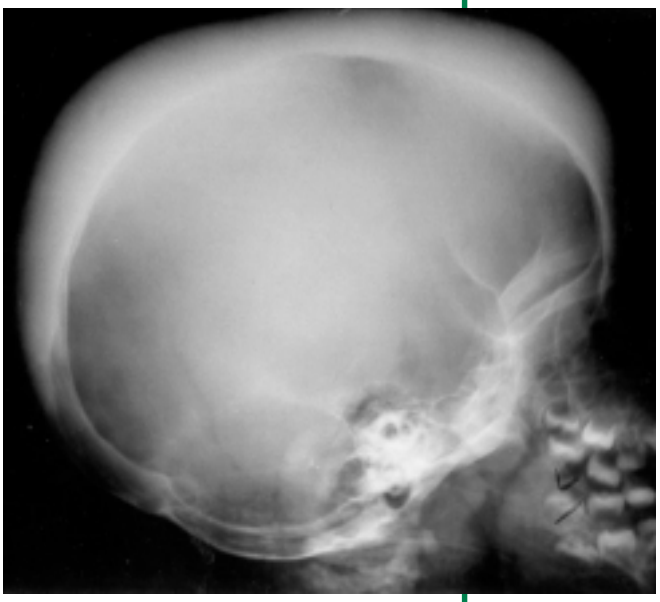

Fig. 3. Lateral skull radiograph of patient having Cooley's anemia. There is a granular thickening of calvarium. This is not a cephalogram as no cephalostat is evident.

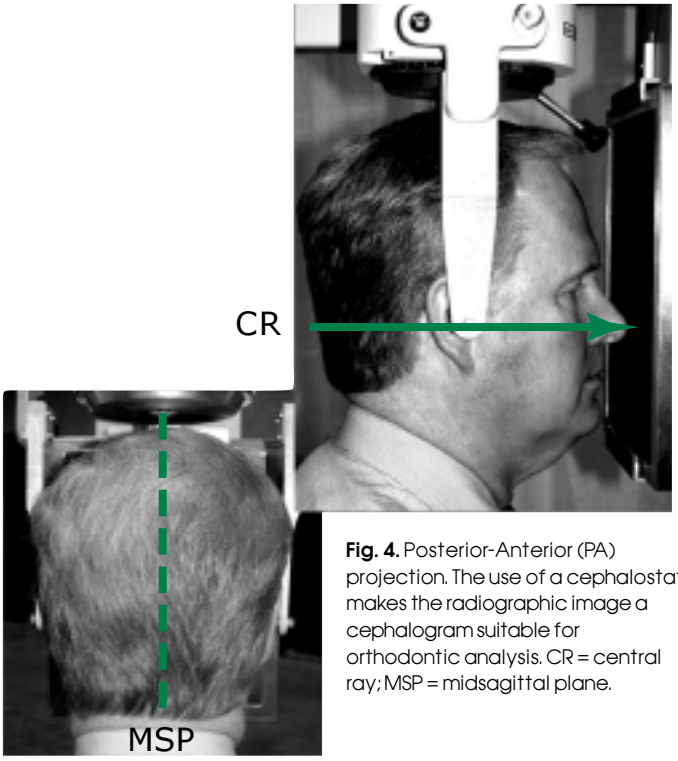

Fig. 4. Posterior-Anterior (PA) projection. The use of a cephalostat makes the radiographic image a cephalogram suitable for orthodontic analysis. CR = central ray; MSP = midsagittal plane.

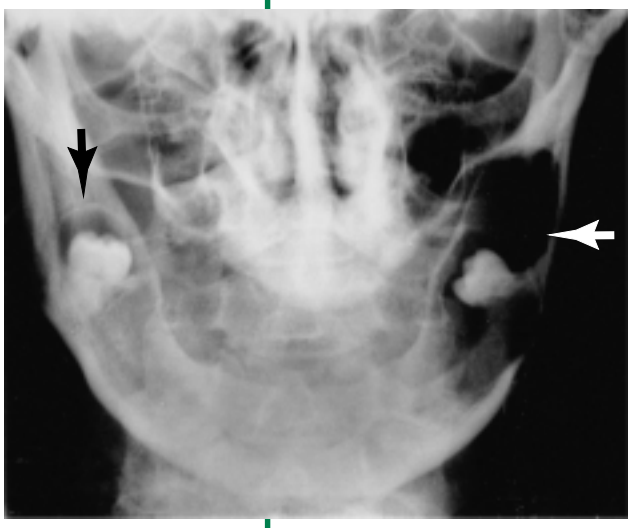

Fig. 5. PA view. Image detail demonstrates bilateral mandibular dentigerous cysts (arrows) in this otherwise edentulous patient.

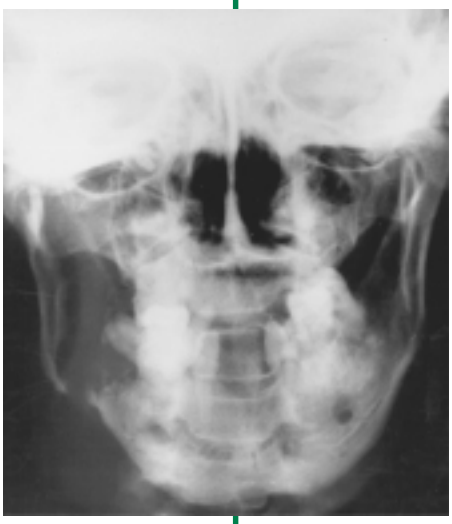

Fig. 6. PA view. Squamous-cell carcinoma involving the right mandible, resulting in a pathological fracture. Note the saucerized erosion typical of an external origin to the lesion.

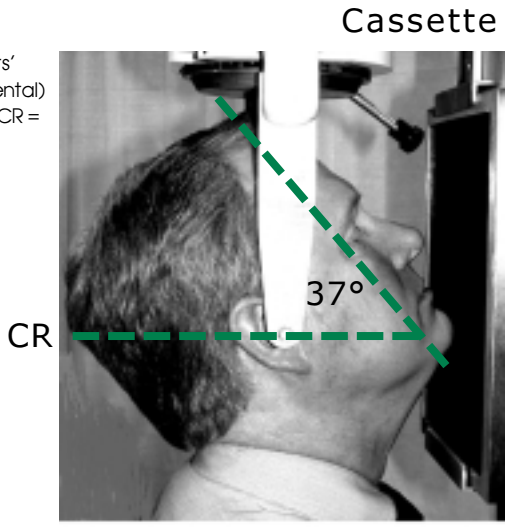

Fig. 7. Waters' (occipitomental) projection. CR = central ray.

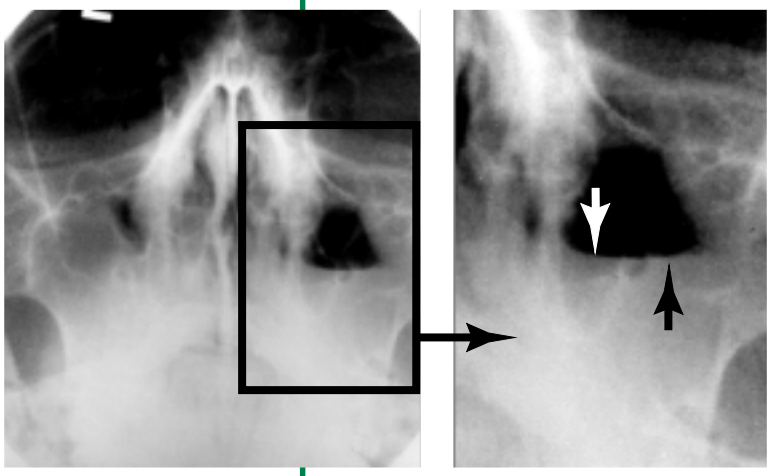

Fig. 8. Acute sinusitis: Waters' view shows opaque right maxillary sinus with classic air-fluid level in the left (arrows).

Occipitomental projection (Waters' technique)

The Waters' technique is a posterior-anterior projection with the skull and beam inclined to prevent superimposition of the highly radio-opaque petrous temporal bones over the maxillary sinuses. The resulting film can be used to inspect the outline of the orbital ridges and floor, the frontal sinus, the maxillary sinuses, the zygomatic arches, the odontoid process of the second cervical vertebra and the mandible.

The patient is positioned with the midsagittal plane perpendicular to the plane of the detector/film cassette (Fig. 7). The patient's chin rests on the cassette and the nose is about 1 inch (3 cm) from the cassette. The tragus-canthal line approximates 37° to the central ray, with the central ray perpendicular to the cassette and centered at the level of the maxillary sinuses.

The resulting image is valuable for evaluation of the lateral and medial walls of the maxillary sinus and to determine a possible fluid level indicative of sinusitis (Fig. 8), or soft tissue proliferations within the sinus. It is also of value as the preliminary view to inspect for possible fractures affecting the zygomatico-maxillary complex. Referral of the patient for further evaluation using computed tomography is advised when fractures are detected.

"The lateral-oblique provides a plain film projection of the posterior dental arches on one side of the patient at a time."

Reverse-Towne's projection

The patient faces the detector cassette with the forehead resting on the cassette, the nose one inch (3 cm) away from the cassette, and the mouth open (to bring the condyles to the crest of the articular eminences). The beam is perpendicular to the detector and parallel to the patient's midsagittal plane. The central ray passes through a point midway between the external auditory media (Fig 9).

This projection is used to demonstrate the coronal aspect of the mandibular condyles to evaluate for possible condylar fractures (and medio-lateral displacement – Fig. 10) following trauma. It is also useful for evaluating the posterior wall of the maxillary sinus, the nasal septum, the mandibular rami and the styloid processes.

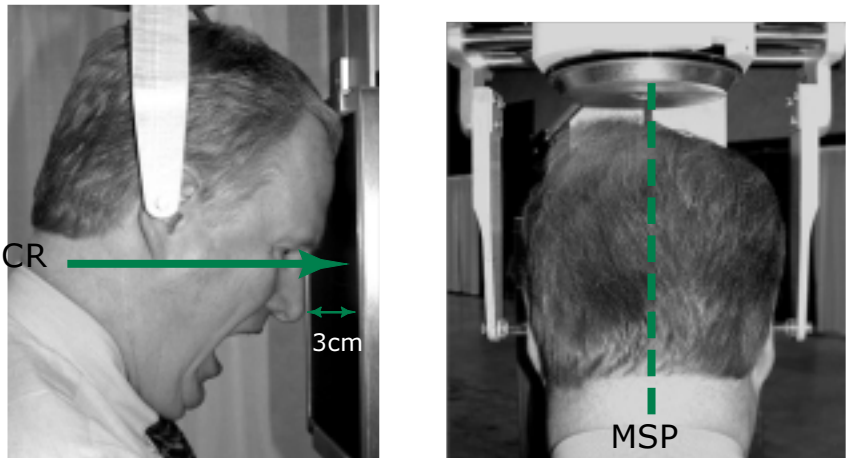

Fig. 9. Reverse Towne's projection. The patient faces the cassette with the forehead touching the cassette, the nose 3 cm from the cassette and the mouth open. The cephalostat is best kept out of the image for this projection. CR = central ray; MSP = midsagittal plane.

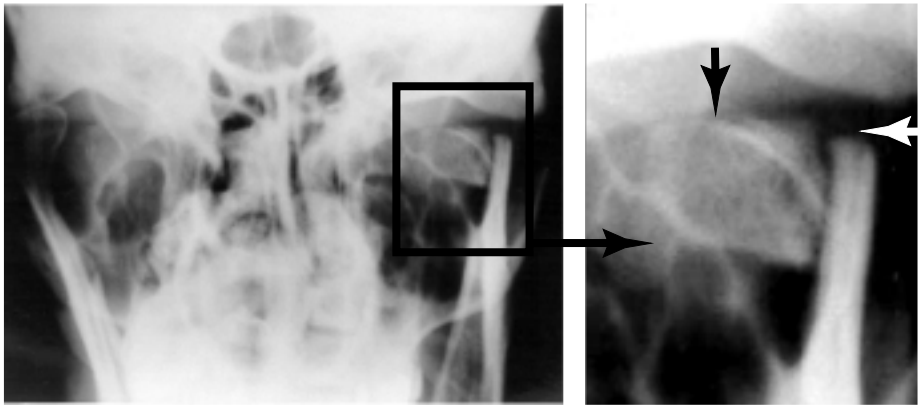

Fig. 10. Reverse Towne's projection demonstrating fracture of left mandibular condyle with medial displacement of mandibular condylar head (arrows in detail).

Submentovertex projection

The submentovertex projection provides a plan or cross-sectional view of the head, providing information on the medio-lateral aspects of the zygomatic arch, mandibular condyles, the sphenoid, ethmoid and maxillary sinuses, and the mastoid air cells and an assessment of mandibular symmetry. It provides a clear view of the foramina in the base of the skull such as foramen ovale, foramen spinosum, and foramen magnum.

The patient faces the x-ray source with the head and neck hyperextended backwards, and the vertex of the skull placed on the detector cassette (Fig. 11 & 12). The tragus-canthal line is perpendicular to the floor and parallel to the cassette. The x-ray beam enters the midline between

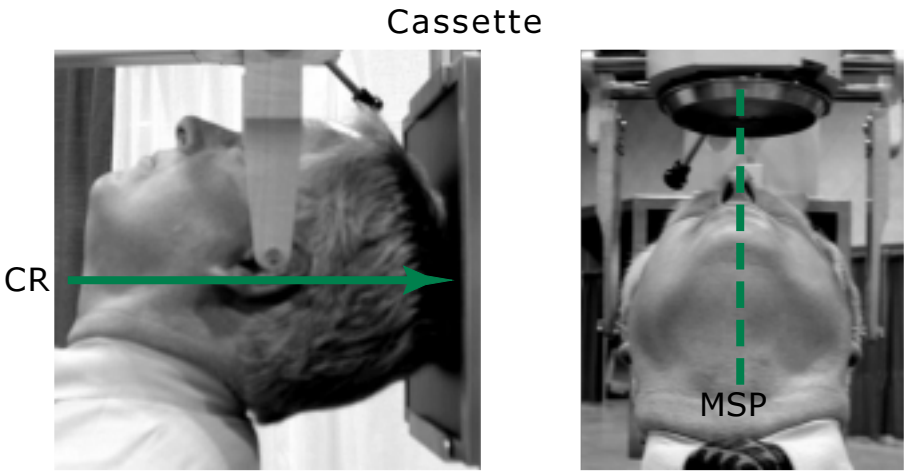

Fig. 11. Submentovertex projection. CR = central ray; MSP = midsagittal plane.

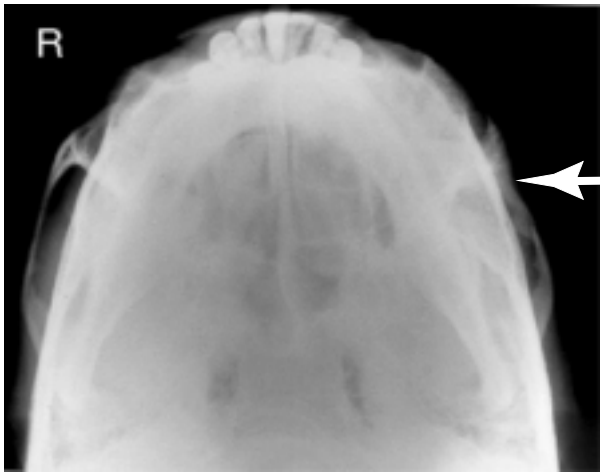

Fig. 12. Submentovertex projection demonstrating depressed fracture of left zygomatic arch. This projection is sometimes known as a "jug-handle" projection in view of the appearance of the normal zygomatic arch as demonstrated on the right side of the image.

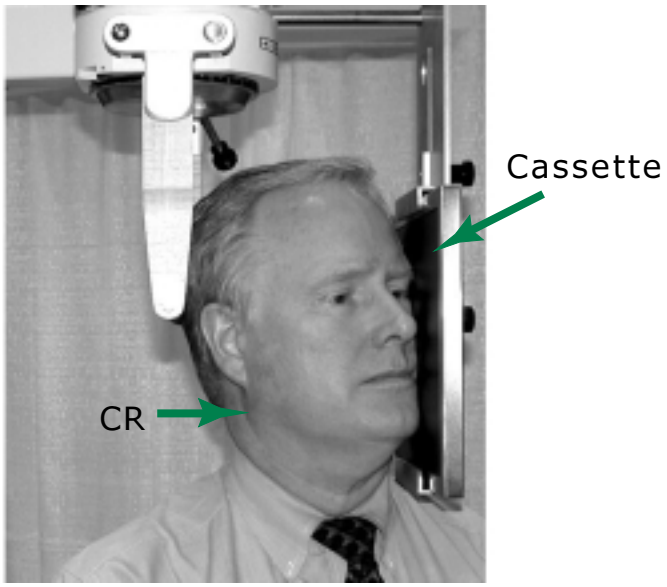

Fig. 13. Lateral-oblique projection of the jaw. The lateral-oblique projection often necessitates the cassette being held by the patient to achieve the desired x-ray beam angulation. CR = central ray

Fig. 14. Lateral-oblique radiograph of a patient with a large residual cyst in the mandible.

the condyles below the chin (the "submento-" component of the projection's name) and exits the vertex of the skull.

Lateral-oblique projection of the jaws

The lateral-oblique provides a plain film projection of the posterior dental arches on one side of the patient at a time. To a great extent, this projection has been replaced by the panoramic dental image. For a view of the posterior jaw segments, the patient is positioned with head rotated towards the cassette, and tilted to achieve a negative beam angulation of -15° to -20° resulting in the beam entering approximately 1 inch (2 cm) below the angle of the mandible on the x-ray tube side (Fig. 13 & 14). The projection can be used to provide a full-thickness view of the posterior dental arch to evaluate impacted third molar teeth, fractures of the mandibular body or pathoses affecting the jaws.

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CE TEST: Increasing the diagnostic role of the cephalometric attachment

1. The plain film radiographic projection most suited to examination of the maxillary sinuses is:
   _____ a) Reverse-Townes
   _____ b) Occipitomental
   _____ c) Lateral Skull
   _____ d) Lateral-oblique

2. The most frequent cassette size used for skull radiographs made using a pan-ceph unit is:
   _____ a) 5 x 7 inches _____ b) 12 x 6 inches
   _____ c) 10 x 8 inches _____ d) None of the above

3. Approximately how far should the patient's nose be from the detector when making a Reverse-Towne's radiograph?
   _____ a) 0 cm (touching cassette)
   _____ b) 1 cm
   _____ c) 3 cm
   _____ d) 10 cm

4. A projection used to inspect for a possible zygomatic arch fracture is:
   _____ a) Waters' view
   _____ b) Submentovertex
   _____ c) PA
   _____ d) More than one of the above

5. In radiological terms "PA" is the acronym for:
   _____ a) Posterior-Anterior
   _____ b) Periapical intraoral projection
   _____ c) Both (a) and (b)

6. Of the following, the most appropriate projection for examining impacted third molar teeth is the:
   _____ a) Submentovertex _____ b) Lateral Skull
   _____ c) Waters' _____ d) Lateral-oblique

7. The submentovertex projection can be used to evaluate the forqamen ovale, foramen spinosum and foramen magnum.
   _____ True _____ False

8. The x-ray source to patient midsagittal plane for lateral cephalometry is:
   _____ a) 16 inches _____ b) 30 inches
   _____ c) 50 inches _____ d) 60 inches

9. For lateral cephalometry in the USA the right side of the patient's face is next to the detector/cassette.
   _____ True _____ False

10. The point of entrance of the beam for the Posterior-Anterior projection is the:
    _____ a) External occipital protruberance
    _____ b) Articular eminence
    _____ c) Skull vertex
    _____ d) Nasal bridge

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