Getting the Most Out of Panoramic Radiographic Interpretation

Allan G. Farman

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Learning Objectives
After reading this chapter, the following knowledge should be gained:
- Appreciation of the formation of the panoramic image
- The ability to identify normal hard tissue and soft tissue anatomic structures depicted in the dental panoramic radiograph

Quality Assurance

As with any other radiographic method, optimum interpretable diagnostic images can only be achieved with careful quality assurance in patient positioning, in selecting appropriate exposure parameters and during processing. While panoramic radiography is easy to perform well if all the manufacturer's instructions are followed, it is equally easy to perform badly. Most errors are due to incorrect patient positioning, leading to excessive and sometimes disproportionate distortion. A correctly positioned patient's panoramic radiograph generally shows symmetry of the size of the mandibular rami and condyles, and the dental segments are "in focus" with a gentle downward convexity of the maxillary arch. Provided the patient bites correctly on the bite-block, the anterior structures are portrayed in the midline and the apices of the mandibular incisor teeth should be in full "focus." Provided that the tongue is kept up in the roof of the mouth during exposure, the roots of the maxillary teeth are clearly demonstrated. It is less expensive in time and materials—and in radiation to the patient—to perfect your panoramic technique, than to make unnecessary repeat exposures. And the diagnostic yield from an excellent panoramic radiograph is far superior to one made under less rigorous quality control.

Image Projection Geometry

To gain the maximum amount of diagnostic information from a dental panoramic radiograph (pantomograph), it is necessary to understand that panoramic radiographs are "flattened out" schemes of a curved image layer. Think of the plan view of the head (Fig. 1.1). The panoramic radiograph provides a plan of one side, then the midline, then the other side of the face and jaws. Imagine the panoramic detector (e.g., X-ray film) wrapped around the outside of the face. The actual panoramic film seems large in comparison with a 3M human phantom (Fig. 1.2). This is because the actual image from most panoramic systems is enlarged by about 20%. Figures 1.3 and 1.4 show a printed panoramic image reduced to life size superimposed on the phantom. These graphically explain the association between the panoramic radiograph and the represented structures. In reality the image is formed section by section behind the secondary slit. Figure 1.5 illustrates this process by putting the same printed panoramic image in place of the film cassette. The relative movement of the X-ray source and the "camera" during exposure creates the effect of "wrapping the film about the patient's face" (Fig. 1.6). This analogy to "film" wrapped around the face is equally applicable to the distribution of anatomic

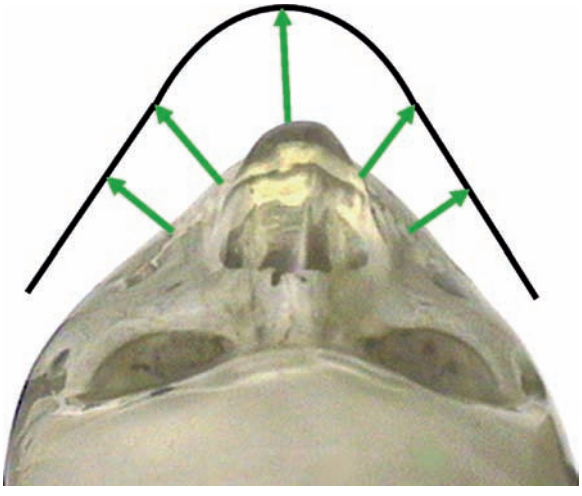

Fig. 1.1 A panoramic radiograph simultaneously presents views from both sides of the patients face as well as providing a frontal perspective

Fig. 1.2 You can best understand the relative position of structures shown in a panoramic radiograph if you imagine the image layer to be bent around the patient's face

Fig. 1.3 The lateral and more posterior structures are projected to each side of the panoramic radiograph

Fig. 1.4 The anterior structures are shown in the midline of the standard panoramic projection

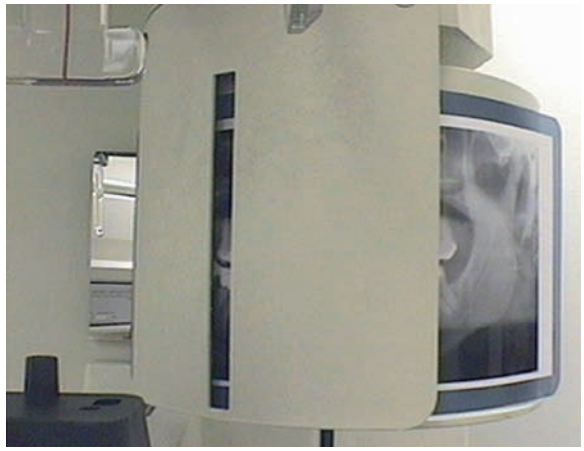

Fig. 1.5 The panoramic image is formed sequentially from information passing through the machine's secondary slit collimator. The film or photostimulable phosphor detector moves past the secondary slit at the appropriate rate necessary to minimize mechanical distortion. For solid-state systems the movement is virtual rather than actual

Fig. 1.6 The panoramic latent image is created as the film cassette moves past the secondary slit. The production of the latent image is simulated using the print of a panoramic radiograph

structures displayed in the image created by digital panoramic systems as it is their analog predecessors.

Interpreting a Normal Panoramic Radiograph

A normal panoramic radiograph contains a substantial amount of information. Figure 1.7 is the PC-1000 (Panoramic Corporation, Fort Wayne, Indiana) panoramic radiograph of a 12-year-old male patient. Fifty distinct soft tissues, bony and dental landmarks have been labeled on this radiograph. This is merely a selection from vast amount of information that is actually present. When was the last time that you consciously and thoroughly inspected all of the structures that are demonstrated? As you probably are making the radiograph with the intent of dental diagnosis at the forefront, the dental arches should be left to last in your systematic evaluation of the image. You can sequence your evaluation in many ways; however, it is very important to develop a consistent approach that ensures that all diagnostic information in the radiograph is indeed read. To see all of the subtle variations in contrast, it is imperative that with film imaging: (1) a view box be used (preferably having a variable light intensity), (2) any extraneous light from the view box be blocked out, and (3) the diagnostic evaluation is performed under subdued ambient lighting away from distractions. Similar rules apply for digital panoramic radiography, but of course the computer monitor replaces the view box. It is suggested that you review all panoramic radiographs made in a given day when all patients have left the practice. It will be surprising how much can be gained from such a second look when the atmosphere is likely to be more relaxed!

You can sequence your evaluation in many ways; however, it is very important to develop a consistent approach that ensures that all diagnostic information in the radiograph is indeed read.

Anatomical Comparisons

I approach reading the radiograph roughly in the numerical sequence shown in Fig. 1.7; namely starting with the bony landmarks from the midline of the upper jaw and nasal cavity, then working back in the maxilla and zygomatic complex on each side. The soft tissue shadows of the tongue and soft palate are incorporated at this stage. This is followed by evaluation of the cervical spine and associated structures. I then evaluate the contents of the mandible starting from the midline and then progressing posteriorly on each side. Any examination would be incomplete without a thorough evaluation of the soft tissues anterior to the spine and inferior to the mandible. The last part of the evaluation should be the area of chief complaint and the dental arches. These regions automatically draw your attention whereas the other features within the radiograph can be missed without careful sequencing.

Using the same numerical key as that for the annotated radiograph (Fig. 1.7), Figs. 1.8 and 1.9 shows the normal anatomical structures viewed from the lateral and frontal facial aspects of a 3M phantom. It should be remembered that the radiograph shows all features within the panoramic image layer whether facial or lingual. It should also be remembered that only the structures that are within the selected image layer will be in "focus." This image layer is generally narrower for the anterior regions than for the posterior segments.

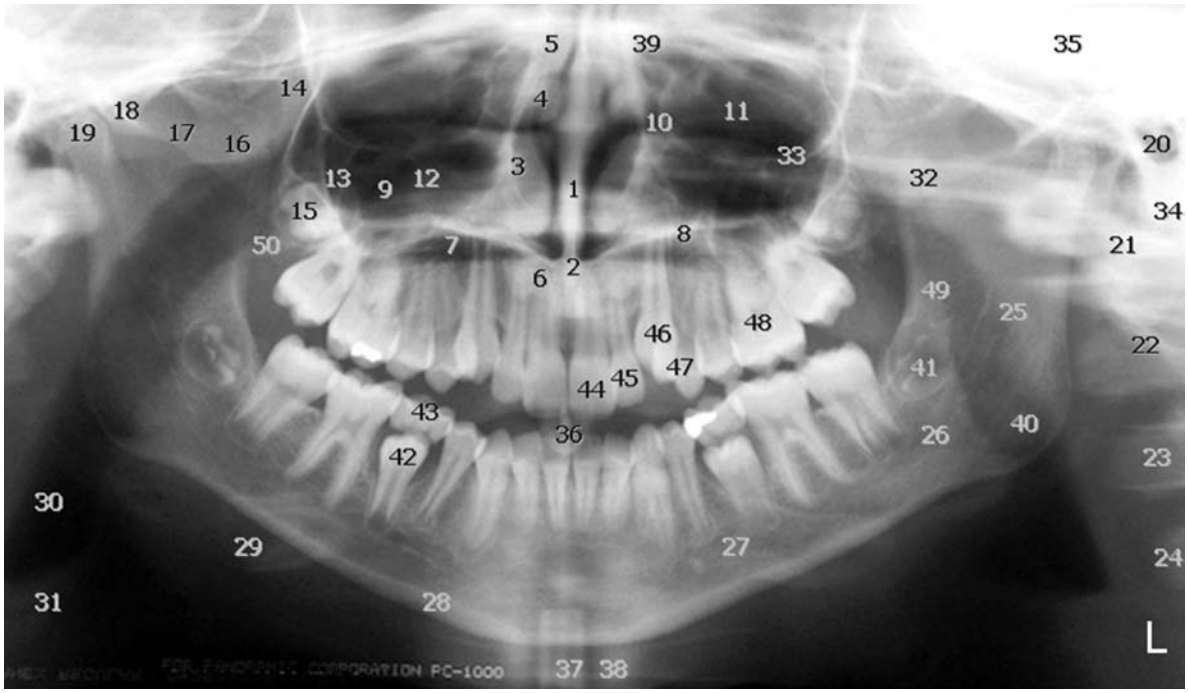

Fig. 1.7 Annotated panoramic radiograph. *1* Nasal septum, *2* anterior nasal spine, *3* inferior turbinate, *4* middle turbinate, *5* superior turbinate, *6* soft tissue shadow of the nose, *7* airspace between soft tissue shadow of upper border of tongue and hard palate, *8* lateral wall of nasal passage, *9* maxillary sinus (antrum), *10* nasolacrimal canal orifice, *11* orbit, *12* infraorbital canal, *13* zygomatic process of the maxilla, *14* pterygomaxillary fissure, *15* maxillary tuberosity with developing third permanent molar tooth, *16* zygoma, *17* zygomatico-temporal structure, *18* articular eminence of temporal bone, *19* mandibular condyle, *20* external auditory meatus, *21* first cervical vertebra (atlas), *22* second cervical vertebra (axis), *23* third cervical vertebra, *24* fourth cervical vertebra, *25* mandibular foramen and lingula, *26* mandibular canal, *27* mental foramen, *28* inferior border of mandible, *29* hyoid, *30* pharyngeal airspace, *31* epiglottis, *32* coronoid process of mandible, *33* inferior orbital rim, *34* mastoid process, *35* middle cranial fossa, *36* bite-block for patient positioning during panoramic radiography, *37* chin holder (cephalostat), *38* shadow of cervical spine, *39* ethmoid sinus, *40* angle of mandible, *41* crypt of developing mandibular third permanent molar tooth, *42* developing mandibular second premolar tooth, *43* primary second molar tooth showing physiological root resorption, *44* maxillary permanent central incisor tooth, *45* maxillary permanent lateral incisor tooth, *46* maxillary permanent canine tooth, *47* maxillary first premolar tooth, *48* maxillary permanent first molar tooth, *49* ramus of mandible, *50* pterygoid plates

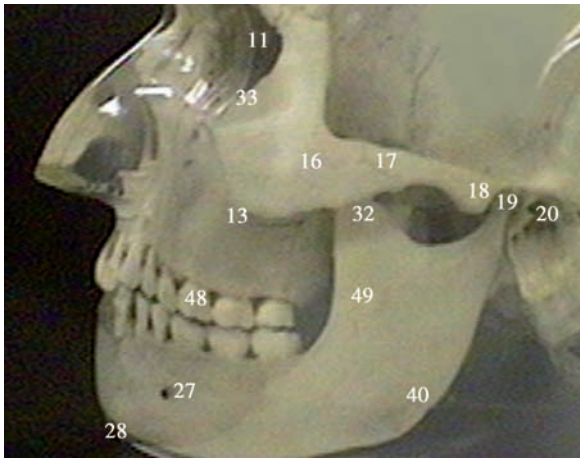

Fig. 1.8 Annotated lateral view of a 3M head phantom. (*Numbers* as in Fig. 1.7)

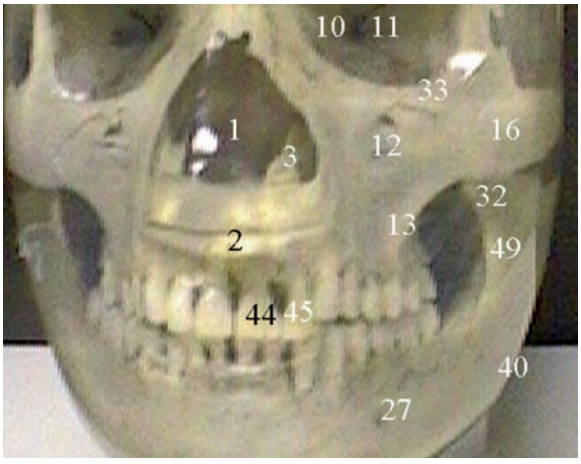

Fig. 1.9 Annotated anterior view of a 3M head phantom. (*Numbers* as in Fig. 1.7)

TEST: Getting the most out of panoramic interpretation

1. In panoramic radiology, the image layer is generally narrower for the anterior regions than for the posterior segments.

   True ☐ **False** ☐

2. Bright ambient lighting is to be preferred when reading panoramic radiographs.

   True ☐ **False** ☐

3. Only the structures that are within the selected image layer will be in "focus."

   True ☐ **False** ☐

4. The sequence for evaluation of a panoramic radiograph should be consistent to ensure that all diagnostic information in the radiograph is read.

   True ☐ **False** ☐

5. The panoramic image is formed sequentially from information passing through the machine's secondary slit.

   True ☐ **False** ☐

6. The lateral and more posterior structures of the maxillofacial region are projected to each side of the panoramic radiograph.

   True ☐ **False** ☐

7. Since panoramic radiographs are primarily to evaluate the teeth and jaws evaluation of the soft tissues anterior to the spine and inferior to the mandible is superfluous.

   True ☐ **False** ☐

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