

Trauma Radiography of the Mandible

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The mandible is the largest and only moveable facial bone. It begins as 2 separate bones and unites anteriorly when a child approaches 1 year of age.¹ Its unique shape causes it to fracture easily, typically in more than 1 place. In the United States, the mandible is the third most fractured bone of the face.² Data from industrialized nations suggest that 43% of mandibular fractures occur because of motor vehicle accidents.³ However, in the United States, 1 study of 134 patients identified violent crimes — specifically, assault and gunshot wounds — as the cause of 50% of mandibular fractures. Motor vehicle accidents were cited as the cause 29% of the time.⁴ This study was retrospectively evaluated; of the 134 patients seen, there were 225 confirmed mandibular fractures, thus emphasizing the likelihood of multiple mandibular fractures occurring in the same patient.

When a trauma patient presents to the emergency department, the trauma team assesses the situation and follows a strict protocol. This includes securing the airway and evaluating breathing and circulation. In this type of scenario, the radiographer initially is involved performing mobile chest and cervical spine radiography. Regarding the mandible in emergency situations, Chang and Lam⁵ suggested that earlier reduction of mandibular fractures results in better outcomes for the patient. However, they also stated that if the patient's condition does not warrant immediate surgical correction, repair of the mandible can be delayed for 5 to 7 days. This suggests that it is not paramount that mandible radiographs be obtained immediately, but they certainly should be obtained as soon as the patient's condition warrants.

At some facilities, high-resolution computed tomography (CT) is currently the imaging modality of choice for the majority of facial bone fractures.⁶ Most plain-film radiography of the face is reserved for evaluating the more common, less crucial injuries, such as nasal bone frac-

tures, or when CT is not available, such as in some rural settings. Furthermore, some facilities have acquired pantomography (Panorex) equipment, which can be extremely helpful when evaluating the mandible. Nevertheless, it is essential for radiographers to know how to perform plain-film studies and how to position the mandible even though this procedure has taken a back seat to CT during the past decade. Mandibular radiography is still a fundamental examination that is ordered often enough that radiographers should maintain the skills required to perform it.

It can be a challenge to perform the axiolateral projections of the mandible on patients who also have cervical injuries. Often these patients cannot be moved. It requires skill and precise positioning to image the mandible in a way that is accurate and demonstrates all of the pertinent anatomy. The intent of this article is to review the anatomy of the mandible and demonstrate a method of performing axiolateral projections on a patient who has a cervical collar in place.

Anatomy

The mandible is a U-shaped bone that houses the lower bridge of teeth. Immediately inferior to the teeth is the alveolar process, which is composed of several interalveolar septa that house the roots. When looking at the mandible on a high-resolution 3-D CT scan, one can see the teeth and the ridges that are formed by the roots as they rest in the alveolar portion of the mandible. (See Fig. 1.)

At midline, the symphysis menti is the point of union between the 2 halves of the mandible. Inferior to the symphysis menti is the mentum, or chin, sometimes also referred to as the mental protuberance. The center of the mental protuberance is called the mental point.¹ There are 2 mental foramina on each side of the mentum that act as passageways for the mental nerves and blood vessels.

The body of the mandible extends posteriorly from the mental point to the gonion, or angle of the jaw. The gonion is an important positioning landmark for radiographers because it correlates to the third cervical vertebra (C3). Just superior to the gonion is the ramus of the mandible. It rises to form the superior portion of the jaw and unites with the mandibular condyle. The posterior process is called the condyloid process. It articulates with the temporal mandibular fossa of the temporal bone to form the temporal mandibular joint (TMJ). This condyloid process has a head and a neck, but then joins with the mandibular notch as it extends anteriorly to unite with the coronoid process. The coronoid process is unique in that it does not articulate with another bone; rather, it acts as an anchor for a muscle attachment.

The Ring Bone Rule

The “ring bone rule” is a paradigm that is taught to residents when they are evaluating mandibular fractures. In short, it states that a ring-shaped bone, such as the mandible, usually fractures in 2 places. Richardson⁶ used the example of pretzels when discussing this paradigm. If you try to break a hard, round pretzel, it breaks in more than 1 place. (Try it when you buy your next bag of pretzels.) His analogy demonstrates that the stiffer the ring bone, the greater the chance of it breaking bilaterally. He then illustrated the ring bone rule with bagels. Bagels are softer but will still fracture in more than 1 place; however, the softer the substance, the easier it is to obtain a unilateral fracture.

At the University of Washington School of Medicine, this is called the “pretzel-bagel spectrum.” Richardson further explained, “What this boils down to is that one sees an average of 1.5 to 1.8 mandibular fractures per customer, depending on whether the mechanism is . . . (a) fist or other anonymous blunt object or . . . (an) automobile crash, respectively. Like the nose, the mandible has a prominent position on the face, making it a favorite target for either of these mechanisms.”⁶

For radiographers, this should emphasize the importance of performing the mandible exam as a bilateral study. Bontrager,¹ Ballenger and Frank⁷ collectively suggested that both sides of the mandible always should be examined for comparison.

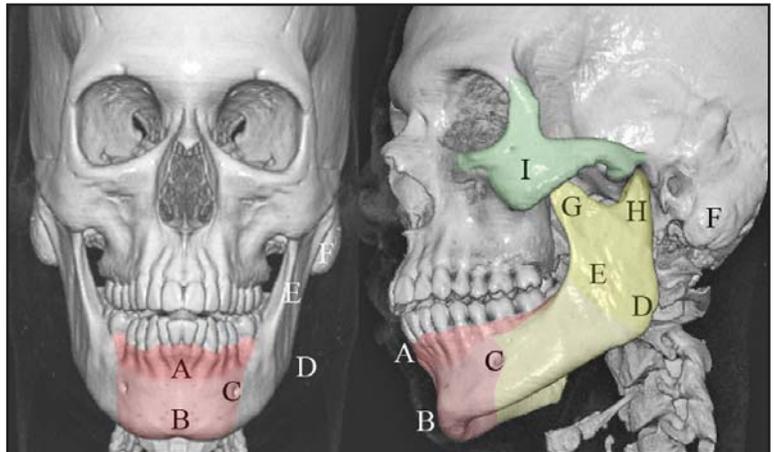


Fig. 1. Mandibular anatomy demonstrated with anteroposterior and oblique high-resolution 3-D CT images. A. The area of the symphysis menti where the 2 halves of the mandible fuse in infancy. B. The mental point. C. The mental foramina. D. The gonion, which correlates with cervical vertebra no. 3, a positioning landmark. The area between C and E is the body of the mandible. E. The ramus. F. The mastoid tip with the unmarked external auditory meatus lying anteriorly and superiorly to it. G. The coronoid process. H. The condyle of the mandible, which forms the TMJ articulation. The mandibular notch extends from H to G. I. The zygoma and zygomatic arch. The alveolar process can be seen as ridges immediately below the lower teeth.

Methods

Even under the best of circumstances with an ambulatory patient, obtaining axiolateral images of the mandible can prove challenging. Change the scenario to a trauma patient in a cervical collar and it makes the most seasoned radiologic technologists feel anxious and get sweaty palms. Typically, a routine mandible series consists of a lateral projection, anteroposterior (AP) and AP-axial (Towne) projections, and bilateral axiolateral projections. The first 3 projections are simple enough, regardless of whether the patient presents in an ambulatory state. However, the bilateral axiolateral projections can be extremely difficult to perform.

To simplify the axiolateral projections of the mandible, think back to all the times you have performed axiolateral imaging of the hip and proximal femur (Danelius-Miller method). This is a common examination performed in trauma situations when the patient has fallen and a fracture of the hip is suspected. Apply the same cross-table approach to imaging the mandible. First, place an imaging receptor (IR) next to the patient's head, making sure that the top of the IR is at

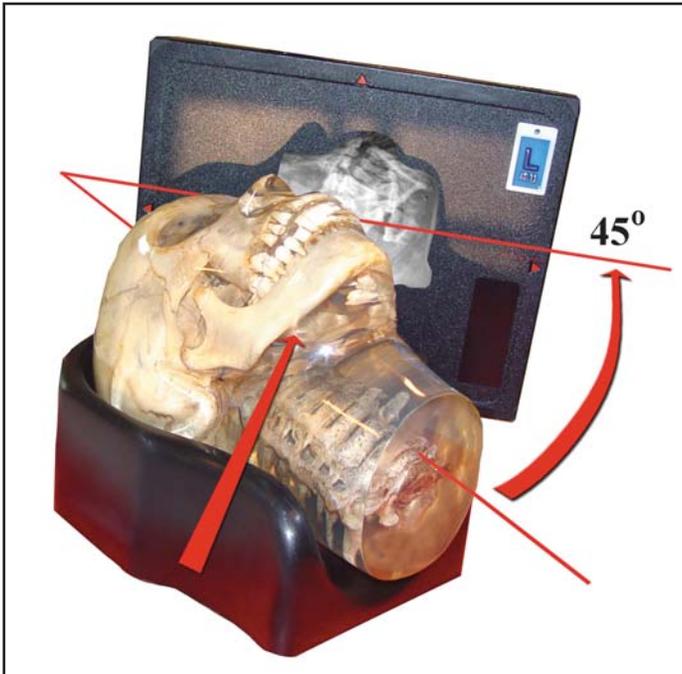


Fig. 2. Positioning for the axiolateral mandibular projection with a phantom. The IR is placed at a 45° angle to the crown of the head and the central ray is directed perpendicular to the IR, entering just superior to the angle of the jaw.

or slightly above the crown of the head. This will ensure that all of the anatomy will be projected on the IR. Rotate the IR 45° away from the patient's midline. (See Fig. 2.) Sponges or a cassette holder can be used to keep the IR in place. Next, position the central ray perpendicular to the IR, entering midway between the mentum and gonion on the contralateral side. (See Fig. 3.) Before taking the exposure, verify that the patient's shoulder closest to the x-ray tube will not be visualized. Last, reposition the tube on the opposite side of the x-ray table and perform the same steps to complete this bilateral study. The ramus and body of the mandible closest to the IR will be adequately demonstrated and free of superimposition. (See Fig. 4.) Implementing this approach produces 2 carbon copy axiolateral images of the mandible.



Fig. 3. Trauma patient positioned for the axiolateral mandibular projection using the same principles as for axiolateral hip imaging (Danelius-Miller method).

Discussion

CT is becoming the modality of choice for imaging the facial bones, but diagnostic radiographs of the mandible still are ordered commonly enough that technologists need to keep their skills sharp. Obtaining high-quality diagnostic images is the radiographer's responsibility, regardless of whether it is a routine examination performed daily or not. This article described an alternate method of obtaining axiolateral mandibular images that can be adapted for a multiplicity of settings. Perhaps this variation will come to mind the next time you must perform a mandible series. ♦

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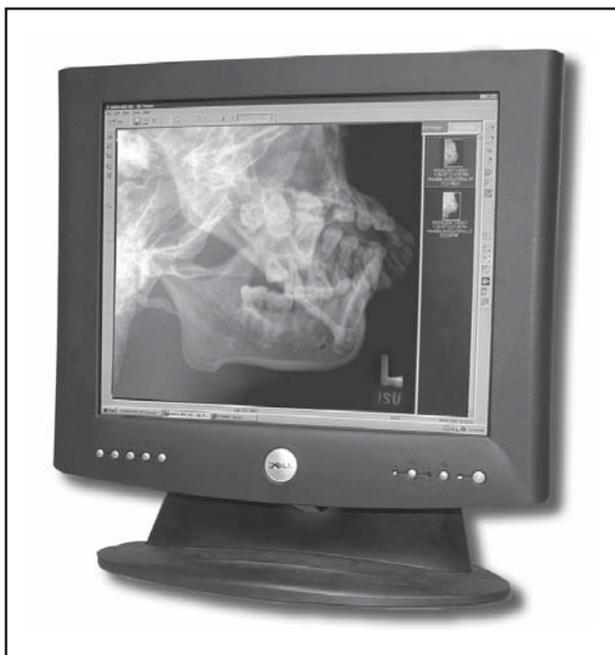


Fig. 4. Computed radiograph of the left mandible, axiolateral projection.