

# Imaging of Dentoalveolar and Jaw Trauma

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## KEYWORDS

- Dental fracture • Luxation • Root fracture • Alveolar bone fracture • Mandibular fracture
- Facial trauma

## KEY POINTS

- Radiographic evaluation is an indispensable tool for diagnosing, assessing, and following-up fractures of the maxillofacial complex.
- Thorough knowledge of dentomaxillofacial plain film and 3-D radiographic anatomy leads to success in the diagnosis of fractures.
- Detailed clinical evaluation is essential prior to any radiographic evaluation/prescription in trauma and fracture cases.
- Radiographic presentation may vary between
  - One or 2 well-defined sharply demarcated line(s) limited to the anatomic structure (rule out artifact).
  - Increase in density/radiopacity within the structure caused by overlap of fragments.
  - Discontinuity of the outline of the osseous and dental structures when a radiolucent fracture line cannot be seen within the structure.
  - Irregularity of the contour and step formation in areas where the osseous or dental structure outline is supposed to be smooth and continuous.

## INTRODUCTION

Radiographic evaluation is an indispensable tool for diagnosing fractures and traumatic injuries to the maxillofacial complex. The presence or absence of a fracture line; the direction, orientation, and space between fragments; and the involvement of surrounding anatomic structures as well as the location of the attached fragments can be determined on radiographic images. If foreign bodies are suspected, their presence, position, number, and shape within the hard and soft tissue structures can be detected radiographically, guiding accurate surgical intervention for removal while sparing the neighboring anatomic structures, such as arteries, veins, nerves, and sinuses. Radiographic evaluation provides an

accurate estimation of the healing process providing the details of osseous fusion and post-traumatic remodeling. Fibrous healing defects can be easily detected in cases of failure of bone fusion. This article presents an overview of the patterns of dental and maxillofacial fractures to familiarize general radiologists with the appearance and significance of common dentoalveolar and jaw fractures.

## RADIOGRAPHIC TECHNIQUES

Detailed clinical evaluation is essential prior to any radiographic prescription and subsequent evaluation in trauma and fracture cases. Variable presentation of fractures, however, even though occurring in the same area, dictates a

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customization of the technique depending on the degree of patient discomfort, gravity of the trauma, and involvement of multiple structures.

When using plain film techniques, 1 projection is usually not enough to provide detailed information about the fracture line, displaced fragments, or involvement of surrounding structures. Two projections made perpendicular to one another are usually used as a minimal requirement, and the addition of the third technique is often required.

Gradually, 3-D imaging, such as CT or cone beam computed tomography (CBCT), is replacing plain film techniques; 3-D imaging provides detailed information of the oral and maxillofacial complex that is less technique sensitive and more comprehensive than that seen with plain film imaging.

For dental and dentoalveolar trauma cases and in the absence of 3-D imaging techniques, such as in a general dentist's office settings, periapical films provide high-resolution images, and the use of multiple projections is indispensable for the detection of a thin alveolar bone fracture. A panoramic radiograph associated with an occlusal projection can be helpful in detecting fractured teeth and direction of the displacement. A panoramic projection combined with posteroanterior (PA) head film can be helpful in detecting condylar process fractures and determining the direction of proximal fragment displacement. A PA coupled with a lateral projection is useful in assessing sinus walls fractures. More complicated trauma cases as well as midface fractures need CT evaluation due to the complexity of the anatomy in this area.<sup>1</sup>

## RADIOGRAPHIC FEATURES OF FRACTURES

The key to success in diagnosis of fractures is a comprehensive knowledge of dentomaxillofacial anatomy as seen on different imaging acquisitions.

A fracture by definition is a separation between 2 fragments of the same anatomic structures, such as tooth or mandible. The separation can extend throughout the structure to reach the adjacent tissues. On plain film imaging, the x-ray beam has to pass through the fracture gap to be able to generate a radiolucent line that can be seen and diagnosed as a fracture line.

The following are the general features that are usually seen radiographically in fracture cases:

- Presence of 1 or 2 well-defined sharply marked lines situated and limited to the anatomic borders of the structure
- Presence of increase in density/radiopacity within the structure caused by the overlap of

the separated fragments due to muscular activity

- Discontinuity of the outline in cases where a radiolucent line cannot be seen within the structure itself
- Irregularity of the contour of the structure with interruption and formation of a step in the areas where the outline is supposed to be smooth and continuous

## DENTAL LUXATION

### Definition

Dental luxation is a general term that covers multiple types of injuries; the common feature is absence of root fracture and absence of alveolar bone fracture. The structures that are mainly affected by luxation incidence are the periodontal ligament (PDL) space and lamina dura.<sup>2</sup>

Luxation injuries include concussion, subluxation, intrusive or extrusive luxation, lateral luxation, and avulsion.

### Etiology

Predominant etiologic factors in the permanent dentition are bicycle injuries, falls, fights and sports injuries. In the primary dentition, falls dominate as the cause.

### Clinical Presentation

The clinical presentation of luxation injuries differs according to the type of injury sustained.<sup>3,4</sup> These can be seen in **Table 1**.

### Radiographic Appearance

The radiographic appearance of luxation injuries differs according to the type of injury sustained. These can be seen in **Table 1** and an example of lateral luxation can be seen in **Fig. 1**.

## DENTAL FRACTURES

### Definition

Dental injuries have been classified according to a variety of factors, such as etiology, anatomy, pathology, and therapeutic considerations. But in general, fractures are mostly divided as coronal fractures and root fractures with and without pulp involvement.

### Crown Fractures

#### Etiology

Etiology is severe force to the teeth sufficient to disrupt the enamel, dentin, or both of a tooth. Predisposing factors include abnormal occlusion, maxillary protrusion, an overjet exceeding 4 mm,

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