

Oral and Maxillofacial Imaging



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KEYWORDS

- Digital radiography • Cone beam computed tomography
- Multidetector computed tomography • Multislice computed tomography • MRI
- Ultrasound • Bone scan • Single photon emission computed tomography

KEY POINTS

- Digital radiography has led to decreased radiation dose to patients.
- Charge coupled devices/complementary metal oxide semiconductors and photostimulable phosphors systems are currently being used as detectors for digital imaging.
- Although computed tomographic (CT) scanners were used for maxillofacial bone imaging in the 1980s and 1990s, the introduction of cone beam CT (CBCT) in the new millennium revolutionized the use of CT for dental and maxillofacial diagnostics. This has become a modality of choice for all implant-related diagnosis and treatment planning in dentistry.
- MRI is being used for diagnosis of maxillofacial conditions with soft tissue involvement as well as temporomandibular joint-related abnormalities.
- PET, PET/CT, PET/MRI, or PET/CBCT fusion techniques are on the rise for the detection of occult pathoses within jaws as well as diagnosis of osteonecrosis of the jaw.

INTRODUCTION

Imaging is an integral part of the Oral and Maxillofacial diagnostics. Before the beginning of any imaging protocol, the health care provider must ask the question, “Where does the imaging fit in within the diagnostic sequence?” In other words, “Do I need the image?” Once the above question has been properly answered, then the next logical question should be, “What type of images should I get?” The choice of image should be the one that is least invasive and most diagnostic. It is often a compromise between the dose and the optimal resolution, if it is a radiation-based image. Other images are selected based on their diagnostic efficacy.

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Why to Image

Imaging is a universal diagnostic tool. In many cases, images uncover the underlying cause of symptoms and form a basis for scientific investigation. Images support the evidence-based case management. Frequently, images document the presence or absence of disease, leading to further investigations that are histologic, immunologic, molecular, or genetic in nature. Finally, images are used for identification of normal anatomic variations so that unnecessary treatment can be avoided.

When to Image

All radiographs are prescribed after a careful clinical examination. They are prescribed only when the clinician anticipates additional diagnostic details from the image. Radiographs are required when the imaging forms a basis for further intervention and follow-up. Last, images are needed because they are the standard of care and necessary to treat the patient.

Where to Image

Isolation of the correct anatomic area as a “suspect” is important. If the pain is from an occult source, then broad-based imaging is called for. The type of trauma or disease suspicion dictates the type of imaging in most cases. Additional indications in dentistry exist, for instance, before implant bone assessment.

How to Image

The details of imaging are largely left to the radiologist and the technical staff. The decision to go digital is dictated by the availability of the imaging technology at the facility. Clinicians’ input in the selection of slice thickness or the viewing angles is extremely important. Examinations with or without contrast or a combination should be identified and requested before the examination. Cine-loop of video recording for magnetic resonance (MR) studies and 3-dimensional (3D) reconstruction for computed tomographic (CT) studies can be requested before the images are acquired.

Although planar radiographs, both film and digital, have become obsolete by the advent of 3D imaging in medicine, planar images continue to be of value, in oral and maxillofacial radiology. Intraoral periapical radiographs and bitewing radiographs continue to be gold standards for assessment of many conditions, especially dental caries and crestal bone loss. 3D imaging has become a necessity for preimplant evaluation of jaws and the diagnosis of pathologic abnormality within the maxillofacial region that was not previously possible with planar radiographs alone.

IMAGING TECHNIQUE AND NORMAL ANATOMY

Intraoral Radiography

Imaging protocols

The paralleling technique is used for geometric accuracy of the images, and a rectangular collimator is used for reducing patient dose as well as increasing the contrast within the image. Intraoral positioning devices are used for achieving the parallelism and stability before any exposure.

Voltage is the potential difference between 2 electrical charges. Within a radiograph tube head, the voltage is measured between the negative cathode and positive anode. Voltage determines the speed of electrons from cathode to anode. When the voltage is increased, the speed of electrons is increased, resulting in the electrons striking the target with greater force, resulting in a radiograph beam with a shorter wavelength. Voltage is measured in volts or kilovolts (1 kV = 1000 V). A polychromatic beam is

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