*Topics in Medicine and Surgery*

# Clinical Technique: Application of Computed Tomography for Diagnosis of Dental Disease in the Rabbit, Guinea Pig, and Chinchilla

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*Abstract*

**Computed tomography (CT) is a well-recognized diagnostic tool in human and traditional companion animal medicine, and is beginning to find application in exotic companion mammals as well. In particular, CT is useful for evaluation of patients with dental disease, and aids diagnosis, determination of a more accurate prognosis, and planning of treatment. Although axial slices provide the most useful information, new reconstruction software allows images to be converted to virtual 3-dimensional forms, providing yet another imaging tool for the practitioner. Copyright 2008 Elsevier Inc. All rights reserved.**

*Key words:* **computed tomography; dentistry; rabbit; guinea pig; chinchilla**

Diagnostic imaging is one critical component of the complete evaluation of dental disease and related complications in rabbit and selected rodent species. Radiographs help evaluate structures not visible during the physical examination and inspection of the oral cavity. However, standard radiography has a number of limitations, including an inability to demonstrate areas of bone loss and osteomyelitis because it is difficult to impossible to isolate single portions of the skull without superimposition of other bony and soft tissue structures. Computed tomography (CT) of the head is an outstanding diagnostic tool that overcomes some of the limitations of standard radiology. The advent of newer CT scanners and the availability of user friendly post-capture image manipulation software make this modality extremely useful and a practical adjunct to standard radiology.

## Computed Tomography

CT is a radiologic technique to obtain multiple, parallel cross-sectional image slices of the tissues of the patient. The name "tomography" comes from the Greek "tomos," which means "to cut," and "gramma," which means "letter" (e.g., image).

Multiple x-ray exposures are made as an x-ray tube within a gantry rotates around the patient and it moves along the gantry on a couch (Fig 1). The final image is generated by a computer.

The concept of "slice" imaging originated from the need to overcome superimposition of imaging that is intrinsic to conventional radiography. In

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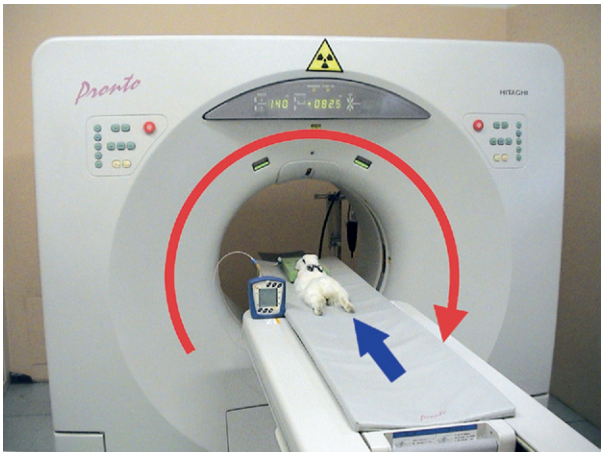


**Figure 1.** Rabbit under general anesthesia with injectable drugs positioned on the couch for CT scanning. Spiral CT scanners collect slices through combined movements of the rotating x-ray tube and movement of the patient through the tunnel. Reprinted from: Capello V, Lennox A: Clinical Radiology of Exotic Companion Mammals. Wiley-Blackwell Publishing (2008), with permission.

actuality, the main difference between CT and traditional radiography is that in the latter, all tissues in the area of interest are superimposed over a single plane.

CT was developed by Godfrey Hounsfield and A. J. Cormack in the early 1970s, and the first scanner was used to image the human head in 1972. Second-, third-, and fourth-generation whole-body scanners were developed in the late 1970s and 1980s, modestly improving scan speed and image resolution. In 1987, the first continuously rotating scanner or spiral scanner was produced. This dramatically reduced scan time because image data could be continuously acquired compared with the start-stop motion of single-slice scanners. Newer CT scans elaborate images via the standardized, internationally recognized DICOM format, which allows a greater number of visual options and virtual 3-dimensional (3D) renderings.

## Basic Operation of a CT Scanner

A narrow cone-shaped x-ray beam is used for CT acquisition and traverses a very small volume or slice of tissue as it moves through an arc of 360°. An array of electronic x-ray detectors records the multiple exposures generated by the x-ray tube. Because the x-ray beam is narrow, slice thickness is generally 1 to 5 mm, and even less than 1 mm with


**Figure 2.** A 2-dimensional multiplanar reformation (MPR) presents the 3 basic planes (axial, lateral, coronal) all together. By moving the "target" (the small red circle), the section planes are selected and automatically reconstructed. Reprinted from: Capello V, Lennox A: Clinical Radiology of Exotic Companion Mammals. Wiley-Blackwell Publishing (2008), with permission.