

# Ear, nose and throat imaging with SCANORA® 3D

The transition from traditional imaging of the ear, nose and throat area to increasing use of cone beam computed tomography for certain diagnostic tasks is being successfully met by the SCANORA® three-dimensional system

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**D**iagnostic imaging in the ear, nose, throat (ENT) area has traditionally been performed with medical computed tomography (CT), magnetic resonance imaging (MRI) and plain radiography units. Nowadays there has been a transition to using more cone-beam computed tomography (CBCT) for certain of these diagnostic tasks. SOREDEX has successfully introduced the SCANORA® three-dimensional (3D) CBCT system for ENT applications, in addition to the dental field where the method already has gained a major role.

## About ENT imaging

With CBCT, it is now possible to image various ENT diseases with an accurate 3D technique. In addition to the earlier conventional use in dentomaxillofacial radiology, it is being increasingly used in the diagnosis of diseases of the sinonasal area, maxillofacial trauma and temporal bone diseases. It has now become popular with clinicians because of its ability to image the structures three dimensionally and at the same time visualise both bony and soft tissue structures with extremely thin section, high-resolution images. The main advantages of CBCT over medical CT are: the comparatively low doses of ionic radiation (3-6 times) it uses; its ability to image extremely thin (sub-millimetre; 0.1-0.2 mm) slices in axial, coronal, sagittal and sub-planes; the automatic generation of surface and volume reconstructions; and the high resolution bony details of the maxilla, mandible and temporal bone it provides.

In the sinonasal region, the origin of the site of infection in sinusitis can be determined with accurate precision using a fairly low dose of ionic radiation with CBCT. Sinusitis can be described

as having one of the three following causes:

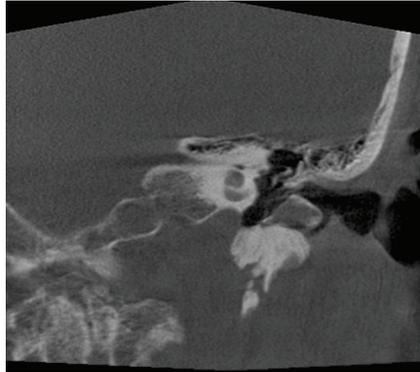
- odontogenic origin - a soft tissue density mass within the sinuses originating from a carious tooth with defective restoration, or extraction site with or without radiographically evident periapical lesion and mucosal thickening limited to the area of the tooth or extraction site in question
- nonodontogenic origin - a soft tissue density mass within the sinuses originating from other reasons such as asthma, allergy and polyposis and absence of carious tooth and mucosal thickening not limited to any tooth
- undetermined origin - a soft tissue mass with carious tooth and mucosal thickening not limited to the affected tooth

All three causes of sinusitis can be well imaged with CBCT. Its use in imaging diseases of the temporal bone and inner ear is now well established. Structures visualised particularly well include the ossicular chain, bony labyrinth of the inner ear, internal cochlear anatomy and the facial nerve. One noted reduced metal artifacts with cochlear implant imaging as well as improved detection of small laser-induced lesions in the ossicular chain when compared to multi-detector CT (MDCT).

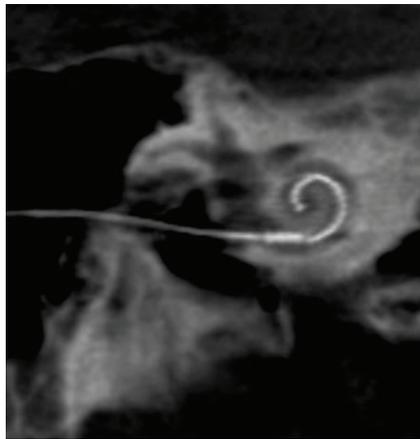
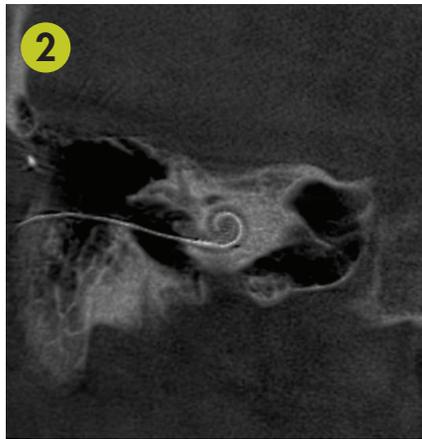
## SCANORA® 3D low dose CBCT system

SCANORA® 3D is a compact CBCT system for diagnostic imaging of the dentomaxillofacial, and head and neck areas. Various field-of-view sizes and high/standard resolutions can be selected for different imaging tasks. The cylindrical field-of-view sizes range from 6x6cm up to 13x14.5cm. The voxel sizes, which represent the spatial resolution, range from 133µm to 350µm. Standard resolution offers

## CASE STUDIES



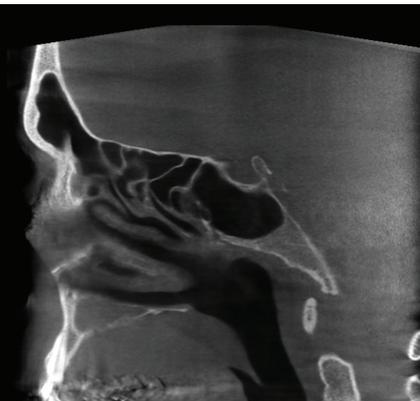
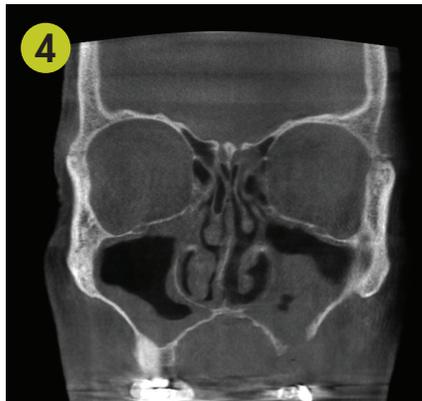
**Case 1.** A 65-year-old woman with a history of sudden nocturnal ear pain and bleeding of the external auditory meatus was referred for CBCT of the left temporal bone. A sausage shaped soft tissue tumour with a thin calcified film at its periphery was found, possibly a complicated granuloma.



**Case 2.** This image shows a 25-year-old deaf patient who recently underwent a cochlear implantation operation on the right ear. Postoperatively hearing was not adequate. So a CBCT of the inner ear was performed because of a suspicion of implant failure. CBCT showed that all the pearls of the intracochlear region were intact.



**Case 3.** A 40-year-old nurse suffering from chronic repeated maxillary sinusitis had been treated with antibiotics unsuccessfully for nearly 10 years. On CBCT an apical cystic lesion of the first left upper molar was observed, which gave rise to maxillary sinusitis of odontogenic origin.



**Case 4.** This image shows a 60-year-old male patient who underwent a tooth extraction operation for repeated infections in the maxilla. A big sinus perforation was observed iatrogenically in the area of removal. This led to considerably odontogenic sinusitis in the left maxillary sinus. In addition there was a presence of polypotic inflammation of the right maxillary sinus.

fast imaging with low dose, suitable for follow-up and measurement tasks. High resolution is recommended for primary diagnostics. In addition to excellent diagnostic performance, special concern has been addressed to the ALARA principle with low patient dose. Dose levels of the SCANORA® 3D are considerably less than with those associated with medical CT imaging, depending on the selected field of view (FOV). With high resolution CBCT imaging of the temporal bone, the dose is approximately equivalent to one to two panoramic images. In high-resolution, sinonasal imaging with a large field of view, the dose is approximately equivalent to three panoramic images. The SCANORA® 3D offers superior versatility by combining cone beam 3D imaging with a CMOS flat panel detector and dental panoramic imaging with a charge-coupled device (CCD) sensor. At the press of a button, the unit automatically switches between 3D and panoramic imaging modes with an AutoSwitch™ function, making it quick and efficient to use. The volume of interest can be freely located in the skull area, thanks to the motorised positioning movements of the unit. The proper volume can be accurately located with laser positioning lights.

The SCANORA® 3D system makes the workflow as fast and efficient as possible. Short scan and reconstruction times further increase the efficiency and usability of the unit. Reconstruction times are fast, starting from one minute.

The flat-panel detector, compared to traditional image intensifiers, offers superior image quality due to its large dynamic range, better contrast and lack of image distortion. Additionally, it is insensitive to electromagnetic interference, compact in size and has a very long service life. The separate CCD sensor for panoramic functioning produces high quality, two-dimensional (2D) images. In addition, the panoramic view can be reconstructed from the 3D data. Then the focal through can be freely adjusted after exposure.

SCANORA® 3D is a total 3D imaging solution and comes with complete 3D software package for advanced diagnostics. Through Digital Imaging and Communications in Medicine (DICOM) support, the SCANORA® 3D system integrates with the picture archiving and communication system (PACS) and is compatible with most third party software, drill and surgical guide applications.



### Clinical use

In this article we report the use of a newly installed SCANORA® 3D in the diagnosis of various diseases of the ear, nose and throat. The machine has been installed in a moderate-sized private radiology clinic in Tampere. During our experience of three months, we have studied patients with acute and chronic sinusitis, temporal bone diseases and inner ear anomalies. The purpose is to analyse the safe use of this new technique in various diseases of ENT.

Our SCANORA® 3D has been principally used to image paranasal sinuses, that is sinusitis and polyposis, where our ENT surgeons have been more than satisfied with the availability of images in 3D planes at extremely low radiation doses to the patient. In the area of head and neck and the temporal bone, its main use in our institution is focused on the preoperative evaluation of the anomalies in maxilla, mandible and that in the inner ear but it has worked equally well in cases with infections and trauma of the temporal bone. The image data has also been used for virtual planning and navigation. ■

### Reference

Miracle AC and Mukherjee SK:  
Conebeam CT of the head  
and neck Part2: Clinical Applications.  
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**SOREDEX** designs, develops, manufactures and markets x-ray imaging systems, with an emphasis on innovative digital solutions. Operating worldwide, SOREDEX offers quality imaging systems of true diagnostic value, based on an in-depth understanding of the practice. Applying three decades of experience of imaging excellence, the company offers reliable and easy-to-use solutions that help clinicians focus on patient care. SOREDEX stands for innovation and value in x-ray technology.

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