

Conventional CT vs Cone-Beam CT (i-CAT)

To whom it may concern,

It is in the interest of this letter to inform the reader of the advantages of using the i-CAT vs Conventional CT.

Cone Beam Computed Tomography (CBCT) or Dental Volume Tomography (DVT) scanners (such as the i-CAT) utilize a cone beam, which radiates from the x-ray source in a cone shape, encompassing a large volume with a single rotation about the patient. Images are then reconstructed using algorithms to produce 3-dimensional images at high resolution.

Conventional CT scanners make use of a fan-beam. Transmitted radiation takes the form of a helix or spiral. The data are then interpolated or re-binned by the scanner into a set of slices making up a volume. Large anatomical regions of the body can be imaged during a single breath hold, reducing the possibility of artifacts caused by patient movement.

Because the i-CAT is a sitting-up machine, it offers more accurate information for dental practitioners. The radiation dose from a conventional CT also does not justify taking a CT scan of, for example, a child in order to make soft tissue measurements.

Conventional CT makes use of a lie-down machine with a large gantry. When patients lie down, the soft tissues tend to collapse.

Radiation Exposure

The radiation exposure to a patient from a conventional CT is approximately 100-300 microsieverts (μSv) for the maxilla and 200-500 μSv for the mandible.[1]

The radiation exposure (for both mandible and maxilla) from the i-CAT is between 34-102 microsieverts (μSv) depending on the time and resolution of the scan.[2]

Type of exposure	Radiation Dose
Conventional CT	Maxilla – 250 μSv Mandible – 480 μSv
Cone Beam CT	Double jaw – 30-100 μSv

Artifacts

Artifacts arising from metal restorations are more severe using conventional CT. More imperative to scan the patient parallel to the occlusal plane to eliminate artifacts in all the slices.

Artifacts that arise from metallic restorations are less severe with the i-CAT. It is less imperative to scan parallel to the occlusal plane to eliminate artifacts when using the i-CAT.

Patient positioning

Conventional CT require the patient's head to be manually tilted to create images suitable for the dentist's needs (e.g. parallel to the occlusal plane, the hard palate, or the lower border of the mandible). When positioning to the lower border of the mandible, the patient's jaw is tilted quite far upward with strain to the neck, which patients find uncomfortable.

Patient positioning is the same for all patients in the i-CAT. The patient's lower jaw is positioned in the chin cup and the forehead stabilized using Velcro straps if necessary. The scan is taken and the images can be re-positioned if necessary using the software.

References:

1. Dula K, Mini R et al. Hypothetical mortality risk associated with spiral computed tomography of the maxilla and mandible. *Eur J Oral Sci* 1996; 104: 503-10
2. Brooks SL. Effective dose of two cone-beam CT scanners: i-CAT and NewTom 3G. *Quarterly Publication of the American Association of Dental Maxillofacial Radiographic Technicians*, Winter 2005