

# Cbct In Dentistry-An Overview

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## ABSTRACT:

Cone Beam Computed Tomography (CBCT) is a three-dimensional imaging technology, which has been specifically developed for imaging of the teeth and jaws. An view of the underlying principles will allow the users of this technology to tailor the imaging protocol to the patient's individual needs to achieve appropriate imaging at the lowest radiation dose. The new technology is more precise and easier for the clinician and the patient. This article discusses about what is CBCT, its evolution, the principals of CBCT, its imaging techniques and safety protocol, its applications, advantages and disadvantages of CBCT, and conclusion.

**Keywords :** Cone Beam Computed Tomography, ALARA principle, Applications.

## INTRODUCTION:

Cone beam computed tomography is a three-dimensional imaging technology, and a very useful tool for proper diagnosis, it is especially useful in dental and maxillofacial radiology[1]. CBCT has been used to overcome the problem with conventional two dimensional radiographic techniques[3].



Figure 1:3D imaging denver co ,CBCT machine. Courtesy:www.wikipedia.com and image search.

## EVOLUTION OF CBCT:

CBCT was invented by sir godfrey N. Hounsefield in 1967. It was introduced in Europe in 1998 and then in U.S. in 2001, CBCT has come to occupy an increasingly important place in diagnosis and in the planning of treatment[2,3].

## PRINCIPLES OF CBCT:

The apparatus consists of a continuous or pulsating X-ray generator emitting a divergent pyramidal or cone-shaped beam that crosses the object to be explored, directed through the middle of the region. The attenuated beam is then analysed by a digital area detector[4]. The patient may be standing, sitting, or in supine position .

The x-ray tube and the flat-panel detector are aligned and joined together in an imaging gantry which turns around the patient in a single, partial or complete rotation scan and record the digital data as data volume[4,5].

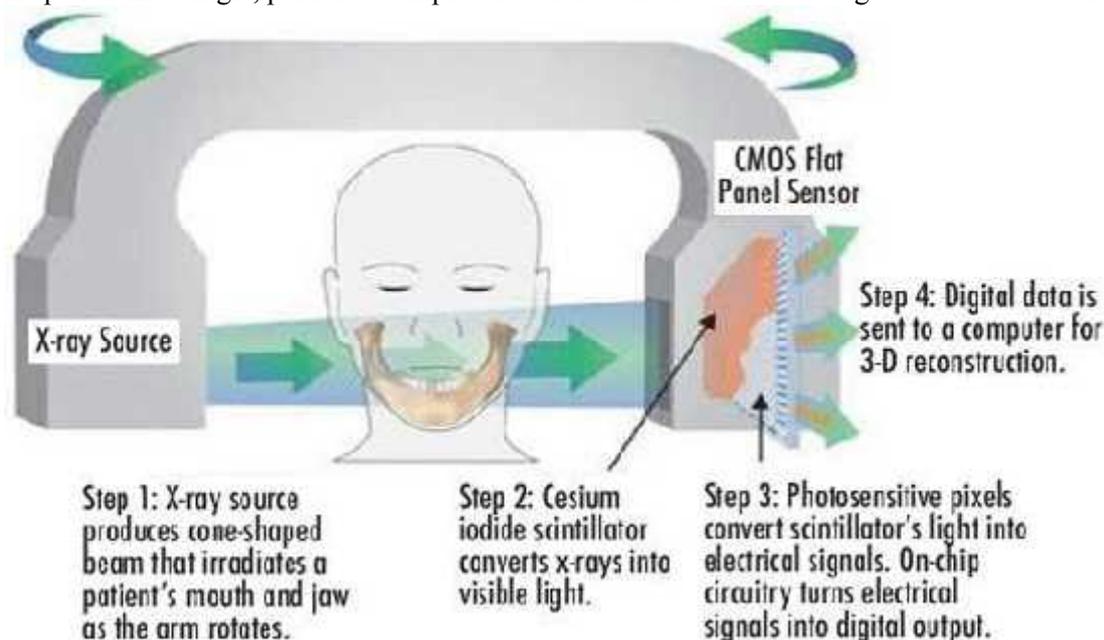


Figure 2: mechanism of formation of the image courtesy: Cone beam CT in dental practise article .

Safety protocol should be kept in mind when ordering for dental CBCT as there are risk of radiation-induced cancer. The “as low as reasonably achievable”(ALARA) principle has changed to “as low as diagnostically acceptable”(ALADA) or “as low as reasonably practicable”(ALARP)[6]. As per international committee on radiation protection, the effective dose for CBCT range from 52 to 1025 micro sieverts[7] .

## APPLICATION OF CBCT IN DENTISTRY:

A CBCT exam should be done only when the diagnostic yield will benefit patient care, enhance patient safety, or significantly improve clinical outcome.

### Application in Endodontics :

CBCT in endodontics have aided in :

- Diagnosis of periapical lesion due to pulpal inflammation
- Visualisation of canal
- Elucidation of canal

- Detection of root fracture. CBCT is formed efficacious in endodontic surgeries and identification of dento-alveolar trauma as well[8,9].

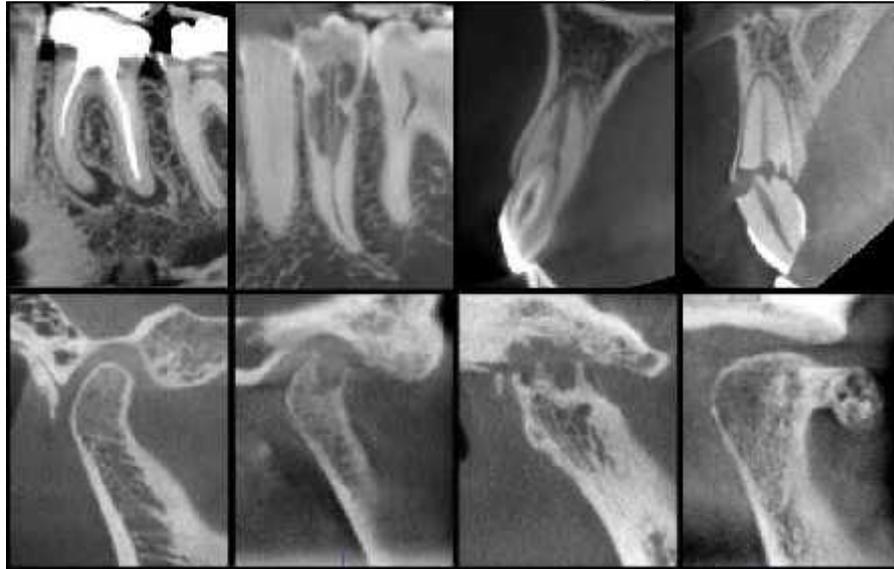


Figure 3: application of CBCT in endodontics courtesy: UCLA CBCT radiology images.

#### Application in Periodontics:

More defined visualisation of lamina dura , crater defect ,furcation involvement and bone quality is possible through CBCT[10].

CBCT image was much superior to conventional radiographs. This can contribute to the clinical decision and improve clinical efficiency[11].



Figure 4: 3D image of mandible courtesy: www.wikipedia.com .

#### Orthodontic application:

CBCT is used for the diagnosis and treatment planning of many complex orthodontic condition and situations like in facial growth, cleft palate ,tooth eruption disturbances or impacted teeth, cleft palate, cleft lip and in orthognathic or craniofacial surgery[12].

### **TMJ(temporo mandibular joint):**

CBCT images can be produced in all 3 different planes hence all the components of the joint is simulated in reconstruction of the defect[13].

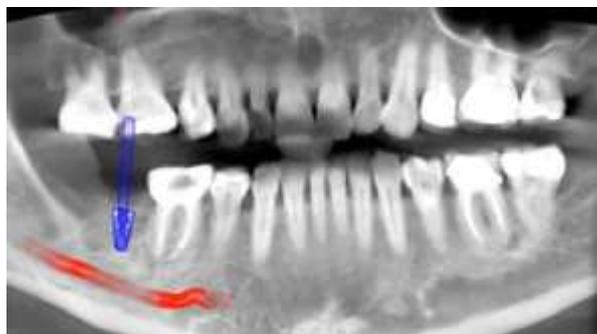


*Figure 5:CBCT scan of the jaws courtesy:www.wikipedia/com*

Bony surface can be checked in all dimension for the identification of pathologies like cortical erosion,subchondral sclerosis,flattening and subchondral cysts[13,14].

### **Implant site assessment:**

Implant site assessment involves assessment of bone density,quality and accurately depicting the vital structure in the area of interest,virtual implant placement allows us to plan surgery before the surgery is performed[15].



*Figure 6:virtual implant surgery through CBCT courtesy:Cone beam CT in dental practise.,British dental journal vol 207 2009.*

### **Cleft lip and cleft palate assessment:**

Cleft lip and cleft palate being a congenital anomaly, radiological imaging's are to be carried out in younger individual. CBCT has low radiation exposure compared to conventional CT[16].

### **CBCT in oral and maxillofacial surgery:**

The exact location of impacted tooth can be indentified . It is always necessary to access the proximity of the impacted tooth to inferior alveolar canal in mandible. Maxillary sinus in maxilla and palatal orientation of canine[17].

### **CBCT in identification of pathological condition:**

It is used to access any pathological conditions such as lesions , cyst, or tumours.

CBCT and MRI together are gold standard for imaging the intra-articular soft tissue components of TMJ.



Figure 7:CBCT finding in the mandible courtesy :ARC journal of dental science.

Due to its lower doses of radiation CBCT has been made the best imaging devices for cases involving trauma, fibro-osseous ankylosis, pain, dysfunction, condylar cortical erosion and cyst [17,18].

#### ADVANTAGES OF CBCT:

- Low radiation (much less than traditional CT scan)
- Convenient and painless for patients
- Aid in the diagnostics, development of treatment plan and procedure.
- Assess risk.
- Better analyze position and orientation of surrounding structures (sinuses, roots, and nerves)
- Cost effective
- Safe for patients of all ages [19].

#### DISADVANTAGES OF CBCT:

- Limited contrast resolution
- Emits radiation
- Streaking and motion artifacts are possible [19].

#### CONCLUSION:

CBCT is an emerging technology which has potential applications for imaging of high contrast structures in the head and neck region as well as oral and maxillofacial regions. Hence CBCT is a promising diagnostic aid in dentistry.

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