



# Cone beamed computed tomography in pediatric dentistry: Concepts revisited



Vivek Mehta<sup>a,\*</sup>, Nafis Ahmad<sup>b</sup>

<sup>a</sup> Department of Pediatric and Preventive Dentistry, Faculty of Dentistry, Jamia Millia Islamia, New Delhi, 110025, India

<sup>b</sup> Department of Prosthodontics and Crown and Bridge, Faculty of Dentistry, Jamia Millia Islamia, New Delhi, 110025, India

## ARTICLE INFO

### Keywords:

Cone beam computed tomography  
Diagnosis  
3-D technology  
Pediatric dentistry

## ABSTRACT

Oral diagnosis and treatment planning is of utmost importance in pediatric dentistry. Although intraoral and conventional radiographic procedures have been used extensively since decades, there two-dimensional representation has raised many questions. Cone beamed computed tomography with 3-D technology is a replacement for conventional 2-D imaging and has a wide application among child patients in pediatric dentistry. This article therefore deals with current facts and myths about clinical situations where CBCT is indicated in pediatric patients.

## 1. Introduction

Oral diagnosis and treatment planning is of paramount importance in pediatric dentistry. Since the advent of X-rays, dental radiology has played an important role in the diagnosis and treatment planning and prognosis of dental diseases in pediatric patients. Imaging modalities like CBCT and orthopantomograph plays an important role in diagnosis and treatment planning. Although conventional radiographic techniques i.e. periapical and panoramic radiography have been used extensively since decades, there two-dimensional representation has raised many questions owing to its limitations such as magnification, superimposition and distortion of images.<sup>1</sup> Cone beamed computed tomography with 3-D technology is a replacement for conventional 2-D imaging and has a wide application among child patients in pediatric dentistry.

### 1.1. Advantages of CBCT

There are a lot of advantages associated with use of CBCT which has made this technique very popular for imaging of the craniofacial region. Some of these advantages are as follows:

1. Image accuracy
2. Rapid scan time
3. Reduced image artifact
4. Reduced radiation dosage
5. X-ray beam limitation

As child patients are more vulnerable to radiation dose therefore use of CBCT should be justified. As children are highly susceptible to ionizing radiations exposure should be kept as low as reasonably achievable.

### 1.2. Basic principles of radiation protection

The three basic and fundamental principles of radiation protection should always be kept in mind by the pediatric dentist before exposing the pediatric patient to unnecessary radiations.

1. **Justification principle**-meaning that radiographs is only indicated if there is no means of obtaining the necessary information. If the patient cannot cope with the procedure, then no radiographs should be taken.
2. **Limitation principle**- It states that the practitioner should always try to keep the radiation dose as low as reasonably achievable (ALARA) as supported by American Dental Association.<sup>2</sup>
3. **Optimization principle**- It states that any practitioner should always try to obtain the best possible diagnostic image.

## 2. Indications of CBCT in pediatric dentistry

### 2.1. Caries

CBCT images display better detection of proximal carious lesions as compared to conventional digital intraoral techniques. However CBCT

\* Corresponding author.

E-mail addresses: [drvivekmehta1@gmail.com](mailto:drvivekmehta1@gmail.com) (V. Mehta), [nahmad7@jmi.ac.in](mailto:nahmad7@jmi.ac.in) (N. Ahmad).

has its own limitations as it is unable to detect carious lesions in metal restored crowns and tooth with radiopaque restorations.<sup>3</sup>

### 2.2. Diagnosis of supernumerary teeth

CBCT evaluation of impacted supernumerary teeth is recommended to reduce the risk of damage to the surrounding anatomical structures as they are in close association with cortical bone.<sup>4</sup>

### 2.3. Endodontic applications

CBCT is a promising diagnostic tool for complex endodontic cases. It is not always feasible to analyze the extent of periapical pathologies, perforations, obturations, root fractures, location of fractured root canal instruments in root canals with traditional radiographic techniques. CBCT is an efficient diagnostic tool to give an enhanced view of calcified canals and missed canals, and to measure root length and angle of curvature.<sup>5</sup>

### 2.4. Dental trauma

It has been found that CBCT can lead to very high diagnostic accuracies for root fractures of non-endodontically treated teeth as compared to conventional periapical radiographs.<sup>6</sup>

### 2.5. TMJ disorders

CBCT is a cost-effective and dose-effective alternative to CT for TMJ examination. It is more advanced in assessment of osseous TMJ abnormalities as compared to traditional imaging modalities like radiography and MRI.<sup>7,8</sup>

### 2.6. Patients undergoing orthodontic treatment

Pediatric patients undergoing orthodontic treatment can benefit from CBCT as it can provide valuable diagnostic information regarding assessment of ankylosed and submerged primary tooth, evaluation of impacted canine and premolar, evaluation of buccal and lingual cortical plates and assessment of proposed sites of temporary anchorage devices. It is also a valuable tool for planning of orthognathic surgeries.<sup>9,10</sup>

### 2.7. Forensic odontology

Currently CBCT has been used commonly in forensic odontology for age estimation, forensic facial reconstruction, analysis of bite-marks, sex determination, and frontal sinus pattern<sup>11–13</sup>

## 3. Future perspectives

### 3.1. Optical scanners with CBCT

Optical scanners have been introduced which combined with CBCT leads to enhanced treatment planning. It helps a clinician in clearly visualizing the patient's anatomy and planning minimal invasive surgeries.<sup>14</sup>

### 3.2. Phase contrast tomography

This is a newer technique utilizing unfiltered radiation from polychromatic source, thereby reducing frequency noise leading to high soft tissue contrast.<sup>14</sup>

## 4. Conclusion

The need of highlighting the use of CBCT in pediatric dentistry is there. The three basic principles of radiation protection should always be kept in mind before recommending the use of CBCT in children. Use of CBCT in pediatric patients should be justified in only those cases where conventional radiography fails to provide relevant information. However we recommend that higher level of research needs to be done to develop guidelines for use of CBCT in pediatric patients.

### Sources of support

Nil.

### Declaration of competing interest

The authors have none to declare.

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