

CBCT Guidelines - A Clinical Review

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Abstract:

The purpose of this article is to review the guidelines on the clinical use of CBCT, in particular the selection criteria, and compare their recommendations. The literature search on CBCT in dentistry was done and the studies were evaluated. There is a wide range of uses for which CBCT can be recorded. The review article shows the indications for CBCT use in different dental specialties. It also describes the potential applications of CBCT and things to consider while using CBCT.

Keywords: Cone-beam computerized tomography, radiography, dental, patient selection practice guideline, evidence-based dentistry.

Introduction

The appearance of newer medical intervention, diagnostic and therapeutic intervention brings new ways to diagnose and treat but at the same time also brings some challenges such as the cost factor. The clinicians have to decide whether the new technology will provide a better quality of life to their patients. Also, the clinicians have to decide whether not using such a technology puts them at a disadvantage. With the launch of CBCT for dental radiology and maxillofacial radiology, several questions like these have been posed by clinicians. Fryback et al. described that a new radiological technique should be efficacious at all levels, including the accuracy in technical aspects and efficacy in social aspects.¹ The growth of CBCT has therefore moved fast and is available in dental and maxillofacial radiology in the past ten years. There are different types of CBCT machines and the specifications vary according to the use.²⁻⁴

The clinical guidelines are a way to provide a baseline to the license for using new technology or technique including CBCT. Guidelines are systematically developed key points which are made for assisting the clinicians and patients in decision-making about appropriate healthcare circumstances.⁵ Three major approaches are key in guidelines development. The first is the opinions of expert panel, second is consensus method, and third is using evidence-based guidelines development methodology. Of all the approaches, evidence-based method of approaching a subject is the best way to achieve a quality assessment of the technique.⁶

Materials and Methods

A literature search was undertaken to analyze the articles published previously on the use of CBCT in dentistry. The eligibility criteria were that studies include the clinical use of CBCT, studies relating to justification and selection criteria of CBCT in any dental specialty, studies published after year 2000 or later, and studies that can benefit the patient and clinicians.

Results and Discussion

A challenge in identifying CBCT guidelines is that it can be published in specialist societies, colleges, and access may be restricted only to members of that particular institution.⁷⁻⁹ The development of selection criteria for CBCT in dentistry is challenging. This is because the evidence based data is very limited for clinical uses. To identify the diagnostic accuracy of CBCT, it is possible to conduct some studies such as dental fracture of teeth as a laboratory model, whereas for others such as periapical inflammatory pathosis, it is not possible to design a study without any risk of bias.

Very few studies conducted on the diagnostic efficacy of CBCT with a randomized trial on the impact of CBCT on patient outcomes.¹⁰ CBCT machines in the market have different image quality and diagnostic capability varies with the quality of the image. Also, the radiation exposure with different CBCT machines is quite different.¹¹

The decision on whether to use a CBCT or not in real practice is affected by multiple factors.¹² Evidence suggests that there is a high degree of variability in prescribing radiographs in different countries and in different states within the same country.¹³⁻¹⁶ This is affected by the teachers, graduates, faculty, key opinion leaders, and the radiology laws of the country. Another aspect is the insurance and payments for different techniques. It has been observed in the United Kingdom (UK) that when the radiological payments were discontinued, it led to a decrease in their utilization.¹⁷ When CBCT is used as an aid for surgical procedure of third molars, it is found that it can help in identifying the exact location of third molar.^{18,19} But it does not change the instruments used for surgical purposes and the technique as the surgeons also depend a lot on the clinical presentation when they raise the flap for surgery. CBCT when utilized for the purpose of cervical vertebral maturation staging, has been shown to be more accurate than conventional radiographs.²⁰ CBCT can also provide accurate measurements of the maxilla and mandible which are found to be increased by 7-8 mm when observed in two dimensional radiographs due to magnification and head position.²⁰ an influential factor for CBCT is the dentists' training and the type of treatment modalities undertaken.²¹⁻²³ CBCT use in endodontics for root canals is routinely done by certain dentists as it helps them visualize the canal completely and not miss an accessory canal.²⁴ But some other dentists still prefer the conventional radiography as their educational training was performed with such radiographs. Orthodontists use CBCT to identify the skeletal and dental effects of maxillary expansion.²⁵⁻²⁹ CBCT is a useful tool for identifying maxillary impacted canines and also identify if the impacted canines have led to root resorption of lateral incisors.³⁰ Maxillary expansion and maxillary protrusion can affect the airway dimensions of patients and can be visualized with CBCT.³¹⁻³⁴ The use of a full field of view in orthodontic CBCT makes it more likely to observe incidental findings and the whole CBCT should be checked for such findings.³⁵ The clinical use of CBCT is open to the types of dental procedures used. Periodontists, prosthodontists, and oral surgeons find CBCT useful when performing implant surgery and planning to identify the exact location of implant.^{36,37} CBCT allows to visualize the bone level and vertical height and the thickness and buccolingual width. Additional procedures such as maxillary sinus lift, and bone grafting can be done prior to implant placement if required as per CBCT evaluation. In orthodontics, CBCT may be helpful while placing mini implants and achieving higher success rates.^{38,39} It is important to note that the interpretation of evidence is key in identifying guidelines regarding the use of CBCT. In animal studies, the use of micro-CT help to identify the bone and dental crown and root structures in high resolution and three dimensions to visualize the root volume and resorption.⁴⁰ CBCT is an adaptation of it in humans with much lower radiation than micro-CT but with also lower resolution. Nonetheless, root volume and resorption have been studied with CBCT.

The practical applications of clinical guidelines for both the patient and the doctor need to be considered for techniques such as CBCT. Recording the CBCT is one aspect, but another aspect is to evaluate the whole CBCT so that no detail is missed out.⁴¹ This requires assistance of a radiologist to see the CBCT and send out a report to the dentist. Artificial Intelligence has made good strides in the field of two dimensional radiographs, but it has still not decoded CBCT analysis completely.⁴² Until such technology is available for CBCT, dentists need to evaluate the complete CBCT to prevent missing any key incidental findings. It is important to be knowledgeable in the evidence regarding CBCT.⁴³ It is in the interest of patients and doctor to identify the situations in which CBCT is beneficial.

Conclusions

The reporting of guidelines for CBCT is important. The limitations and deficiencies of the publications should be taken into consideration while applying CBCT into clinical practice. With an assembly of multidisciplinary team, the applications of CBCT can benefit in indicated situations. Different dental specialties use CBCT for various reasons. When CBCT is recorded, the whole volume need to be screened for any potential incidental findings.

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