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REVIEW ARTICLE

CONE BEAM COMPUTED TOMOGRAPHY (CBCT): A REVIEW

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ABSTRACT:
Cone-Beam Tomography has been well recognized in the current era as a salient method of imaging which can aid in the process of diagnosis by dispensing an exorbitant quality of 3 dimensional structure. Contemplating the encouraging results achieved by the cone beam computed tomography on the fields of Implantology as well as orthodontics, measures need to be taken to employ CBCT into other branches of dentistry as well. The core purpose of the article is to comprehend the concept of CBCT and its application into variegated fields.
Key words: CBCT; Modern Dentistry; Procedures.

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INTRODUCTION:
Over the last decade, it cannot be dismissed that stupendous procurement has been achieved in the field of dental sciences. However, holistic approaches for development of novel technology for advanced diagnostic aids in the form of CBCT and others is obligatory.[1] These form of imaging techniques have been empowering dentists and other health care personnel to ameliorate their diagnosis and subsequent treatment plans.
Inspite of the variegated advanced diagnostic techniques available, Imaging has been considered as one of the most indispensable process for evaluation and analysis.[2] Imaging, especially cone beam computed tomography, has been now acknowledged as one of the most appropriate non-invasive diagnostic procedure. With uses not limited to dental pathologies, radiology has been instrumental in playing a critical role for judging the current treatment plan for overall health of the patient.[3] However, radiology has enormous limitations usually associated with human errors in the form of inappropriate use of the armamentarium leading to distortion of images, ghost images, and super-imposed images along with foreshortening. Nevertheless, innumerable endeavors have been taken into action to reduce the image distortion and use best interpretation skills to conclude an expedient conclusion. Upto a certain level, cone beam computed tomography has been commendable to reduce such errors but the excessive charges and considerable radiation dose have been responsible to confine its use.[4]

EVOLUTION: As one of the most renowned personalities, especially for his work on evolution theory, Charles Darwin has equitably mentioned that change is inevitable and it is attributed to a better cause. Relating to the field of radiographic imaging, starting from the former techniques such as the straightforward peri-apical intra oral radiograph and now pursing innovations in the form of cone beam computed tomography. The massive attention to CBCT is because of its cross-sectional imaging which proves to be inestimable adjunct to the diagnosis of dental pathologies. Such impeccable changes and variations over a period of time have immensely contributed to the advancement of imaging.[5]

PRINCIPLE: CBCT has been the most innovative approach in the sector of imaging with a complete transformation from two dimensional to three dimensional imaging adding to the image reconstruction as well.[6] The technique has been augmented stupendously due to the availability of CBCTscanners which have been carefully formulated to adequately project the image of Oral and Maxillo-facial region.[7] The process of a sole scan involves the revolution of the source of the X-ray tube as well as

the sensor surrounding the head and neck region resulting into numerous segmented imaging pictography of the location involved. The pictography done is a part of the raw data collected by the sensor which needs processing. The processing is done in terms of volume elementscalled Voxels which converts the raw data to the three dimensional structure by replicating the anatomy of the involved subject. The unit voxels is synchronous to Rubik's cube[8], as little as 0.1 to 0.4mm for every cube face resulting into a splendid resolution.[9]

CBCT IMAGE PRODUCTION: The most recent suggested patient postures for accurate imaging using CBCT have been listed below in Table 1.

TABLE 1- Patient Postures

SITTING
STANDING
SUPINE

While erect standing is most commonly employed method, supine position is preferred in patient with a physical disability.[10]

CBCT ADVANTAGES:

1) **RAPID SCAN TIME:** CBCT has a cardinal feature of a single uniform rotation which secures the complete image in a very short period of time causing minimum discomfort to the patient. The basic advantage of a single rotation pictography is that it would reduce the chances of appearance of artifacts related to the abrupt motion change of the patient.[11]
2) **BEAM LIMITATION1:** Based on the area of interest considering the suspected pathology in a patient, the x-ray beam can be targeted on that particular region. This would result into restrained irradiation only to a particular area on the human body. Moreover, judicious use of collimation may also aid in beam limitation.[12]
3) **IMAGE ACCURACY:** Since precision is now an inseparable part of a diagnostic aid, CBCT imaging results into development of images with volume elements as declined as 0.076mm. This leads to an accurate depiction which is usually desired for the placement of implant or in a case of oral-maxillofacial surgery.[13]
4) **DECLINE PATIENT DOSE EXPOSURE:** According to the reports and analysis, it has been established that patient dose exposure usually ranges from 29 to 477 msv. This depends on the type of the equipment used and the area of interest involved on the patients' body.[14]

CBCT DISADVANTAGES:

1) **ARTIFACTS**: Artifacts can be described as an undesirable entity present on an image due to a processing error. The most common reasons associated with artifacts includes X-ray beam artifact, subjective movement of patient and poor scanner detection.
2) **IMAGE NOISE:** Due to considerate amount of scattering associated with the X-ray radiation, there is an unnecessary additional pixel record which is referred to as an image noise.
3) **INFERIOR SOFT TISSUE CONTRAST:** Scattered radiation along with the image noise is significantly responsible for an inferior soft tissue contrast.

SUMMARY& CONCLUSION: CBCT is an invigorating technique that could immensely devote to diagnostic tasks in the field of dental science. Ever since its first use for the purpose of angiography in early 1980s, it has been evolved to work especially in the head and neck region. Nevertheless, a clinician must be fully trained to exploit the technique in the best possible way and interpret the various anatomic structures in the image.[15]

The use of CBCT is not only restricted to head and neck region or implant placement, but it is now widely recognized in Endodontics as well as Orthodontics. Other uses involve revelation of conditions like sleep apnea too. In spite of a significant preliminary cost of the equipment, it is considerably economical in day to day use with less chances of artifacts or distortion. Newer innovations need to be employed to judiciously exploit the different uses of the Cone Beam Computed Tomography.

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