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Review Article

Different uses of cone beam computed tomography in oral and maxillofacial surgery: A review

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ABSTRACT

Cone beam computed tomography is one of the useful imaging technique in the field of oral and maxillofacial surgery. Cone beam computed tomography is a three-dimensional analysis of the bone of head and neck region that helps the surgeon to get to know the position of the lesion, size of the lesion, and extent of the lesion, it also helps in the determining the prognosis of the treatment to be done.

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1. Introduction

There are so many critical areas in the head and neck region, that are found to be difficult to have a look that too prior opening surgically. Cone beam computed tomography helps in giving the three-dimensional imaging of the these critical areas, prior to surgically opening , also aids in avoiding the damage to the critical structures in the surrounding areas like some nerves, arteries. Cone beam computed tomography provides three-dimensional as well as multiplanar view for accurate diagnosis and treatment planning that too without radiation exposure and financial burden to the patient. Cone beam computed tomography is used in various aspects in the field of oral and maxillofacial surgery like, for the process of implant placement, for surgical removal of impacted tooth, different dentoalveolar surgeries, different oral and maxillofacial surgeries, orthognathic surgeries, imaging for

temporomandibular disorders, maxillofacial facial region trauma.

2. Dento Alveolar Surgeries

Most of the dento alveolar surgeries like removal of tooth i.e. decayed, or removal of root stumps requires only periapical radiograph of the particular tooth or at the particular site. But for the removal of impacted tooth or teeth, a three-dimensional view of the impacted tooth or teeth is required to check the exact tilt of the tooth , to check the amount of bone covering the tooth, to check the extent of the impacted tooth to the critical structures like nerves, arteries, so as to avoid damage to the vital structures, and to finally evaluate the prognosis of the treatment. In these type of cases, cone beam computed tomography is required and plays an important role in the surgical removal of the same.¹⁻³

Cone beam computed tomography plays an important role in determining the exact position of impacted third

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molars in the mandibular arch as well as in the maxillary arch, so as to avoid the displacement of the root fragments to the underlying vital structures such as to avoid damage to the inferior alveolar nerve while removal of mandibular third molar, avoid damage to the maxillary sinus while removing impacted first molar, as well as avoid damage to the underlying soft tissue as well as hard tissue. According to a study done by Sun et al., concluded that the panoramic radiography has very less or inadequate sensitivity for ruling out the risks for the nerve damage. Cone beam computed tomography helps in providing the relationship of inferior alveolar nerve as well as the impacted third molars in coronal as well as in the sagittal plane, that helps in the surgeon to get the exact distance in all the dimensions that is vertical, horizontal and lateral from the vital surrounding structures. Cone beam computed tomography helps in exact localization of inferior alveolar nerve in the bucco lingual direction, so in any case if the nerve is located lingually, it will help in clearly dictating the surgical approach so as to avoid the damage to the nerve in any instance.

Cone beam computed tomography plays an important role in determining the extent of maxillary molar root in to the maxillary sinus. Literature revealed that panoramic as well as periapical radiography is inadequate in demonstrating the relationship of maxillary sinus to the surrounding structures. Literature revealed the⁴ panoramic radiography as well as periapical radiography is found to be inadequate in the determining the relationship of the tooth root exact to the maxillary sinus wall. But on the other hand cone beam computed tomography shows the exact position of the maxillary root in to the maxillary sinus wall, and found to be of great value before going any surgical procedure in the area that is closely related to the maxillary sinus wall.

3. Impacted Canines

Cone beam computed tomography is very much helpful in determining the exact position of the impacted canine, the extent of the canine root, the direction in which the canine is impacted, the depth at which the canine is covered with the alveolar bone, it also helps in determining the bucco lingual exact location of the impacted canine, it helps in determining the root dilaceration in all directions. Literature revealed that cone beam computed tomography is found to be a better option than panoramic radiography as well as periapical radiography to get the exact location of the impacted canine. Cone beam computed tomography also aids in determining the root resorption on the buccal surfaces that can not be determined with the conventional radiographic two-dimensional techniques. Literature revealed that there is significant difference found between the two dimension imaging technique and three dimensional imaging technique i.e. cone beam computed tomography, in terms of width, location of the impacted

canine, angulation of the impacted canine and also in terms of root resorption of the adjacent tooth.⁵⁻⁷

4. Supernumerary Teeth

Cone beam computed tomography is very much helpful in determining the size of the supernumerary tooth or teeth in maxillary or the mandibular jaw, the exact location of the supernumerary tooth in the jaw, angulation of the supernumerary tooth or teeth. Although all these things i.e. size, location and angulation of the supernumerary teeth can be determined with the help of the two-dimensional radiographic techniques, but literature revealed that there is statistical significant difference in localization of supernumerary teeth, when localization is done with the help of cone beam computed tomography technique. Cone beam, computed tomography also aids in pre treatment evaluation of supernumerary teeth.^{8,9}

5. Implant Placement

Getting to know the exact anatomy of the alveolar bone is very much required before the placement of an implant. Cone beam computed tomography is very much helpful in determining the exact bone morphology at the surgical site, cone beam computed tomography provides adequate details of which type of bone is present at the implant site. Cone beam computed tomography provides the three-dimensional view of the architecture of the alveolar bone and the amount of bone present at the surgical site area. A study revealed that cone beam computed tomography has very much significant advantage in measuring the bone height alveolar in the nasal floor region due to superimposition of the hard palate.

Cone beam computed tomography has the ability of measuring the width of buccal alveolar bone, when immediate implant is planned in the anterior maxillary region.^{9,10} cone beam computed tomography helps in visualizing the thickness of buccal and lingual cortices, helps in determining the vertical height of the alveolar bone in relation to the maxillary sinus, and angle of the alveolar bone with respect to the occlusal plane is best visualized by the use of cone beam computed tomography.¹¹ literature revealed that when so ever precise information of the alveolar bone in respect to alveolar bone height, bone width is required, one should must go for cone beam computed tomography three dimensional imaging as CBCT is found to be the first modality of choice.¹¹ In various surgical alveolar bone augmentation procedure, such as alveolar bone grafting procedure before implant placement or during implant placement, maxillary sinus lift procedure and in cases of ridge splitting and one planned for zygomatic implant placements, literature revealed that cone beam computed tomography is the only reliable and indicated imaging modality in the pre operative assessment of

implant placement in the above said procedures.¹² Guereero revealed that cone beam computed tomography provide more spatial information regarding the availability of bone with respect to bone height and bone width when compared to the information provided by two-dimensional imaging technique. Cone beam computed tomography helps in preoperative determination of any bony lesion, as panoramic radiography is helpful in those cases where the borders of the lesions are properly defined, respective of size and location of the lesion.¹³⁻¹⁵

5.1. Other uses of cone beam computed tomography in oral and maxillofacial surgery

It Is used in diagnosis of various tumors of the oral and maxillofacial region, it is used to locate the exact position of the soft or hard tissue lesion in the oral and maxillofacial region, it is also helpful in locating and exactly determining the extent of the soft or hard tissue lesion in the oral and maxillofacial region.^{7,9} It is also helpful in determining the prognosis of the treatment. It is also helpful in determining the space infection.^{8,10,12,14} It is helpful in planning various orthognathic surgeries, it is very helpful in determining the exact position of the cyst, dimension of various cystic lesion, extent of cystic lesion and prognosis with respect to the same.

6. Conclusion

Cone beam computed tomography helps in evaluating the lesion of oral cavity as well as lesions of head and neck region resulting in providing high quality images of the lesion that too without any distortion of the image along with lower radiation exposure to the patient along with decreased cost. It offers the dentist to make accurate or precise measurements of an lesions that are present in the head and neck region and it can make accurate measurements in terms of height and width of the alveolar bone.

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8. Conflict of Interest

None.

References

1. Ohman A, Kivijarvi K, Blomback U, Flygare L. Pre-operative radiographic evaluation of lower third molars with computed tomography. *Dentomaxillofac Radiol.* 2006;35(1):30-5.
2. Sekerci A, Sisman Y. Comparison between digital panoramic radiography and cone-beam computed tomography for the identification of the mandibular canal as part of presurgical dental implant assessment. *J Oral Maxillofac Surg.* 2008;66(10):2130-5.
3. Matzen LH, Wenzel A. Efficacy of CBCT for assessment of impacted mandibular third molars: a review - based on a hierarchical model of evidence. *Dentomaxillofac Radiol.* 2015;44(1):20140189.

4. Tyndall DA, Brooks SL. Selection criteria for dental implant site imaging: a position paper of the American Academy of Oral and Maxillofacial radiology. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2000;89(5):630-7.
5. Preda L, Fianza AL, Maggio ED, Dore R, Schifino MR, Campani R, et al. The use of spiral computed tomography in the localization of impacted maxillary canines. *Dentomaxillofac Radiol.* 1997;26(4):236-41.
6. Alqerban A, Jacobs R, Fieus S, Willems G. Comparison of two cone beam computed tomographic systems versus panoramic imaging for localization of impacted maxillary canines and detection of root resorption. *Eur J Orthod.* 2011;33(1):93-102.
7. Liu DG, Zhang WL, Zhang ZY, Wu YT, Ma XC. Three-dimensional evaluations of supernumerary teeth using cone-beam computed tomography for 487 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2007;103(3):403-11.
8. Bokkasam V, Muddepalli P, Jayam R, Devaki S, Pakerla A, Koduri S. Comparison of panoramic radiograph with cone-beam computed tomography in assessment of maxillary sinus floor and nasal floor. *J Indian Acad Oral Med Radiol.* 2015;27(2):194-7.
9. Nowzari H, Molayem S, Chiu CHK, Rich SK. Cone beam computed tomographic measurement of maxillary central incisors to determine prevalence of facial alveolar bone width ≥ 2 mm. *Clin Implant Dent Relat Res.* 2012;14(4):595-602.
10. Yoshimine SI, Nishihara K, Nozoe E, Yoshimine M, Nakamura N. Topographic analysis of maxillary premolars and molars and maxillary sinus using cone beam computed tomography. *Implant Dent.* 2012;21(6):528-35.
11. Sharan A, Madjar D. Correlation between maxillary sinus floor topography and relative root position of posterior teeth using Orthopantomograph and Digital Volumetric Tomography. *Asian J Med Sci.* 2017;8(1):26-31.
12. Tyndall D, Brooks S. Selection criteria for dental implant site imaging: a position paper of the American Academy of Oral and Maxillofacial radiology. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2000;89(5):630-7.
13. Lim LZ, Padilla RJ, Reside GJ, Tyndall DA. Comparing panoramic radiographs and cone beam computed tomography: Impact on radiographic features and differential diagnoses. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2018;S2212:4403-18.
14. Chuenchompoonut V, Ida M, Honda E, Kurabayashi T. Accuracy of panoramic radiography in assessing the dimensions of radiolucent jaw lesions with distinct or indistinct borders. *Dentomaxillofac Radiol.* 2003;32(2):80-6.
15. Kaneda T, Minami M, Kurabayashi T. Benign odontogenic tumors of the mandible and maxilla. *Neuroimaging Clin N Am.* 2003;13(3):495-507.

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