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Assessment of various radiological techniques in the evaluation of impacted and supernumerary teeth: A comparative study

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Abstract

Background: From past many years, the peri-apical and occlusal radiographs have dominated the intraoral radiography techniques for diagnostic purposes. Three-dimensional images of the oral and maxillofacial structures have been made possible by Cone beam computed tomography. Hence; we undertook the present study to compare various radiological techniques in the evaluation of supernumerary and impacted teeth.

Materials & Methods: The present study included assessment of 30 patients who were found to have supernumerary or impacted teeth. A pre-operative CBCT was done in all the cases and patients were subsequently sent for panoramic radiography. Among the 30 patients, in 2 cases, conventional panoramic radiography was done while in 10 cases, digital radiography was used. All the patients aged between 10 to 45 years of age with mean age being 18 years. The preoperative expected anatomical localization was recorded. The "gold standard" was the intra-operative surgical findings. All the results were analyzed by SPSS software.

Results: Out of 30 patients, 28 of them were having correct pre-operative findings while only two patients were found to have divergence. Therefore, 93.33 percent of the patients had correct pre-operative CBCT finding.. Pre-operative correct findings were recorded in 56.67 percent of the subjects from conventional radiography. Divergence from the correct diagnosis was observed in 43.33 percent of the subjects on conventional radiography.

Conclusion: Precise information, anatomically, is provided more efficiently by CBCT

Keywords: Impacted, Supernumerary, Teeth

Introduction

Since past many years, the peri-apical and occlusal radiographs have dominated the intraoral radiography techniques for diagnostic purposes [1, 2]. However, these techniques are also subjected to some disadvantages. Superimposition of various anatomical structures is one such disadvantage which makes the correct diagnosis of the location of a lesion is sometimes impossible [3]. Three-dimensional (3D) images of the oral and maxillofacial structures has been made possible by Cone beam computed tomography (CBCT) by providing a high resolution of 0.001 mm3 voxels, and these 3D images can provide a better understanding of many anatomical structures [4, 5]. Hence; we undertook the present study to compare various radiological techniques in the evaluation of supernumerary and impacted teeth.

Materials & Methods

The present study was conducted in the department of oral medicine and radiology of the dental institution and included assessment of 30 patients who were found to have supernumerary or impacted teeth. Ethical approval was taken from institutional ethical committee and written consent was obtained after explaining in detail the entire research protocol. A pre-operative CBCT was done in all the cases and patients were subsequently sent for panoramic radiography. Among the 30 patients, in 2 cases, conventional panoramic radiography was done while in 10 cases, digital radiography was used. All the patients aged between 10 to 45 years of age with mean age being 18 years.

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No craniofacial or other osseous deformity was detected in any of the patient in the present study. Exclusion criteria for the present study included:

- Patients with acute symptoms,
- Patients with history of any systemic illness,
- Patients having any type of odontogenic abscess,

Patient and relatives received full information about the study and its purpose. All patients were scanned in 2D and 3D plans. Every single conventional and CBCT image was analyzed and evaluated pre- and intra-operatively by three independent, both X-ray diagnostically and surgically experienced colleagues. The objects of interest were researched with the magnification method. The superimposition of the critical structures was significant for the localization. The preoperative expected anatomical localization was recorded. The "gold standard" was the intra-operative surgical findings. Postoperatively, the images were reanalyzed in order to obtain the specificity and precision of the radiography. The evaluation of the preoperative imaging diagnostic and the intra-operative findings was recorded on a compiled scoring sheet, bounded with the patient identification number. All the results were analyzed by SPSS software. Chi-square test and univariate were used for the assessment of level of significance.

Results

Table 1 and Graph 1 show preoperative and intra-operative anatomical findings from the CBCT. Out of 30 patients, 28 of them were having correct pre-operative findings while only two patients were found to have divergence. Therefore, 93.33 percent of the patients had correct pre-operative CBCT finding. Table 2 and Graph 2 show preoperative and intra-operative anatomical findings from the conventional X-ray. Pre-operative correct findings were recorded in 56.67 percent of the subjects from conventional radiography. Divergence from the correct diagnosis was observed in 43.33 percent of the subjects on conventional radiography.

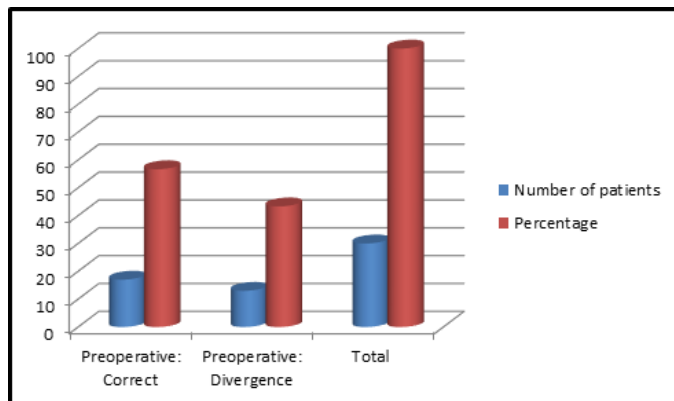**Table 1:** Preoperative and intra-operative anatomical findings from the CBCT

Parameter	Number of patients	Percentage
Preoperative: Correct	28	93.33
Preoperative: Divergence	2	6.67
Total	30	100
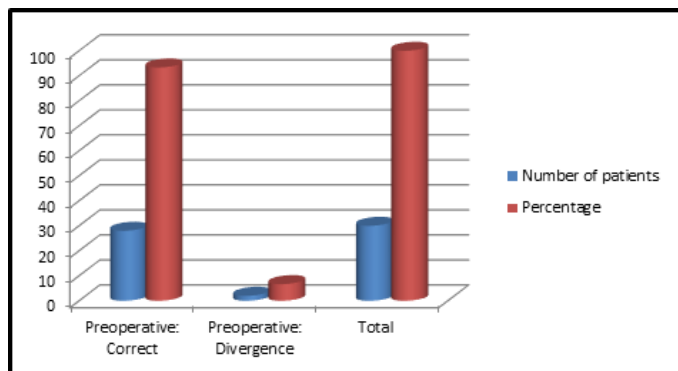
Graph 1: Preoperative and intra-operative anatomical findings from the CBCT

Table 2: Preoperative and intra-operative anatomical findings from the conventional X-ray

Parameter	Number of patients	Percentage
Preoperative: Correct	17	56.67
Preoperative: Divergence	13	43.33
Total	30	100

Graph 2: Preoperative and intra-operative anatomical findings from the conventional X-ray

Discussion

In today's scenario in the field of 3D imaging and radiology, an increase in the number of different types of commercial CBCT devices has been seen.[6] A better visualization of impacted and supernumerary teeth in all planes with a 3D view has been made possible with the CT and CBCT.[7, 8] In order to achieve the best diagnostic efficacy, and consequently the best therapeutic results, 3D-CBCT was applied to show critical regions of interest or to clarify uncertain diagnostic questions and indistinct clinical findings, in which conventional 2D radiological diagnosis seemed not to be sufficient.[9, 10] Hence; we undertook the present study to compare various radiological techniques in the evaluation of supernumerary and impacted teeth.

In the present study, we observed highly accurate anatomical and morphological imaging with CBCT which revealed detailed imaging of the significant anatomical structures in comparison with intra-operative findings (Table 1, Table 2). Mossaz *et al.* presented diagnostic workflow and current treatment concepts of supernumerary teeth in the maxilla and mandible. Proper localization of supernumerary teeth is very important for the diagnosis, treatment planning, and prior to any surgical intervention. Traditionally, supernumerary teeth were diagnosed and located using two-dimensional (2D) radiographic methods such as panoramic views, cephalometric imaging, and also intraoral (also often occlusal) radiographs. With the introduction of cone beam computed tomography (CBCT) in dental medicine, this three-dimensional (3D) imaging technique is now more and more used for the exact localisation of supernumerary teeth and the diagnosis of root resorption of adjacent teeth [11].

Katheria *et al.* determined if cone beam computed tomography (CBCT) is more effective than traditional radiography (TR) in diagnosing pediatric dental clinical cases involving impacted and supernumerary teeth. Surveys were given to 10 pediatric dental faculty and 10 pediatric dental residents after viewing 8 clinical cases in either CBCT or TR in which the patient presented with pathology (impaction or supernumerary) in the anterior maxilla. The surveys asked for pathology diagnosis, location, and identification of root resorption, as well as questions about the usefulness of the radiographic mode in treatment planning. A statistically significant difference in CBCT vs. TR viewed cases was found with CBCT statistically better (P<0.05) for pathology location, determining root resorption, usefulness, adequacy in treatment planning, and was the overall recommended mode. CBCT and TR were effective in the initial diagnosis of pathology in the cases presented. CBCT, however, provides more information on the location of pathology, the presence of root resorption, and

treatment planning [12]. Gurgel *et al.* presented three case reports of patients with supernumerary teeth to demonstrate the need for accurate diagnosis and treatment planning based on a comprehensive evaluation using CBCT. Conventional radiographic images are frequently used to detect supernumerary teeth. However, recent developments in 3D imaging systems have enabled dentists to better visualize supernumerary teeth, with better contrast and more details. CBCT has improved diagnosis and treatment planning of patients with supernumerary teeth. The decision to use CBCT should be based on the diagnostic information required [13].

Alqerban *et al.* compared the diagnostic accuracy for the localization of impacted canines and the detection of canine-induced root resorption of maxillary incisors between conventional radiographic procedures using one two-dimensional (2D) panoramic radiograph with that of two three-dimensional (3D) CBCT scans. The clinical records of 60 consecutive patients who had impacted or ectopically erupting maxillary canines were identified from those seeking orthodontic treatment. For each case, two sets of radiographic information were obtained. The study sample was divided into two groups: group A (n = 30) included those for whom a dental pantomograph (DPT) and CBCT obtained with a 3D Accuitomo-XYZ Slice View Tomograph were available and group B (n = 30) who had a DPT and CBCT obtained with a Scanora. The results of this study suggested that CBCT is more sensitive than conventional radiography for both canine localization and identification of root resorption of adjacent teeth [14].

Ziegler *et al.* reviewed a total of 61 patients of whom majority had impacted teeth or supernumerary elements in the frontal maxillary region were studied with CBCT and treated at the St. Olavs University Hospital. The objects of interest were researched with the magnification method. Each patient was identified only with a patient number. In contrast to the conventional X-rays, the pre-surgical evaluation with the CBCT revealed detailed imaging of significant anatomical structures and objects of interest, with highly accurate anatomical and morphologic imaging, when compared to the intra-operative findings. The CBCT provides true and precise anatomical information with high surgical predictability without distortion or artefacts, and is superior to conventional radiography. It enables more time-efficient surgeries and reduces costs and surgical complications [15].

Conclusion
From the above results, the authors concluded that precise information, anatomically, is provided more efficiently by CBCT. However, future studies are required for better exploration of this field of diagnosis.

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