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ASSESSMENT OF CONE BEAM COMPUTER TOMOGRAPHY (CBCT) IN DIAGNOSIS OF DIFFERENT JAW LESIONS CO-RELATING WITH HISTOPATHOLOGICAL DIAGNOSIS AS A GOLD STANDARD

Dental Science

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ABSTRACT

Aim. To determine the agreement rate between histopathologic diagnosis and radiographic interpretation of jaw lesions.
Methods. Preoperative cbct interpretations and post operative histopathologic diagnosis were compared for agreement.
Results. A total of 20 cases were included in the study. The agreement rate between histopathologic diagnosis and radiographic interpretation was found to be 80%.
Conclusion. CBCT findings might predict histologic results more accurately.

KEYWORDS

CBCT, Histopathology, Jaw Lesions, Radiology

INTRODUCTION:

Preoperative radiographical assessment of the maxillofacial lesions is of a great importance in guiding the surgeon during surgical procedure in reducing post-operative complications.[1] Panoramic radiography has long been considered the gold standard for evaluation of different jaw lesions.[2] However, although two-dimensional (2D) radiological studies provide relevant information, in many situations they have limitations, such as indicating the location and size of a lesion in the buccolingual plane, showing characteristics of the surface (smooth or rough), and demonstrating changes that develop over the period of time in order to evaluate progression of the lesion.[3]

CBCT enables a large quantity of data to be acquired within a spam of short time and low dose of radiation compared with conventional computed tomography (CT). CBCT uses a conical X-ray beam (in contrast to the fan beam of conventional CT) and a special detector that, depending on the technology developed by the manufacturers, may be an image intensifier tube or an amorphous silicon flat-panel detector. The X-ray source and reciprocal detector rotate synchronously around the head of the patient, in a single scan.[4]

Single projection images are known as basis images, these acquired at predetermined degree intervals. Software programs incorporating back-filtered projection are applied to the series of base images to generate a 3D volumetric data set, creating a spherical or a cylindrical volume called the "field of view" (FOV), which can be used to provide primary reconstruction images in three orthogonal planes (axial, sagittal, and coronal).

This study highlighted the application of CBCT scan in the assessment of different maxillofacial lesions as a part of advanced radiology. Clinical and histological studies have shown that CBCT enables the detection of various jaw lesions before they would be apparent on the conventional radiographs, presenting findings closer to the gold standard, which is the histologic evaluation. Nowadays, CBCT appeared to change the view and diagnosis way of by providing an accurate evaluation and treatment planning prior to operation.

The aim of this study was to evaluate the accuracy of CBCT impression in diagnosis of various jaw lesions co-relating with histopathological findings as a gold standard.

MATERIALS AND METHODS:

This study has been conducted on selected patients reported in our consultancy from the month of July to November 2019.

CBCT scan (ICAT 17-19) machine with Vision software (Imaging Science International) utilized to perform scanning of all patients in order to assess lesion extension, morphological features and it's relation to the adjacent vital structures.

Image analysis

Preoperative CBCT images were completed and reviewed for each patient, three-dimensional image initially utilized to make visualization of the lesion to make provisional diagnosis.

Intra operative findings were recorded and post operative histopathological diagnosis were compared with the radiologic assessment of the lesions.

RESULTS:

A total of 20 patients were (11 males and 09 females) taken in this prospective study. In which 08 were of upper jaw and 12 were of mandibular lesions (Table 2). In our findings we observed that 16 out of 20 radiological provisional diagnosis has been correlating with histopathological final diagnosis. (Table 1)

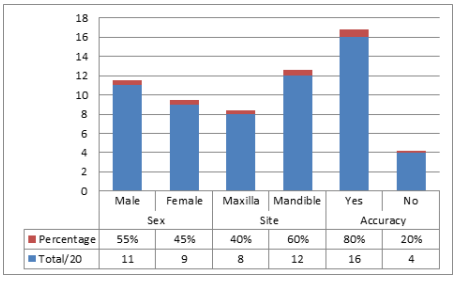
Table 1- Data analysis of radiological diagnosis with histopathological diagnosis of the patients.

S. No.	Age	Sex	Site	CBCT provisional diagnosis	Histopathological final diagnosis	Agreement
1.	20	F	Maxilla	Periapical lesion	Periapical granuloma	Yes
2.	28	F	Mandible	Cement-osseous dysplasia	Compound Osteoma	Yes
3.	10	M	Maxilla	Dento-alveolar abscess	Granulation tissue	Yes
4.	23	M	Maxilla	Condensing osteitis	Traumatic neuroma	No
5.	28	F	Mandible	Odontogenic keratocyst	Central hemangioma	No

6.	26	F	Maxilla	Periapical abcess	Granulation tissue	Yes
7.	27	M	Mandible	Odontogenic cyst	Odontogenic keratocyst	Yes
8.	28	M	Maxilla	Adenomatoid odontogenic tumor	Adenomatoid odontogenic tumor	Yes
9.	16	F	Mandible	Dentigerous cyst	Dentigerous cyst	Yes
10.	24	F	Maxilla	Radicular cyst	Radicular cyst	Yes
11.	32	M	Maxilla	Odontogenic cyst	Odontogenic keratocyst	Yes
12.	55	F	Mandible	Osteomyelitis	Squamous cell carcinoma	No
13.	27	M	Maxilla	Malignant tumor	Mucoepidermoid carcinoma	Yes
14.	45	F	Mandible	Residual cyst	Radicular/Inflammatory cyst	Yes
15.	23	F	Mandible	Fibro-osseous lesion	Ossifying fibroma	Yes
16.	25	M	Mandible	Periapical granuloma	Radicular cyst	Yes
17.	34	M	Mandible	Ameloblastoma	Traumatic bone cyst	No
18.	25	M	Mandible	Odontogenic neoplasm	Ameloblastoma	Yes
19.	37	M	Mandible	Malignant neoplasm	Squamous cell carcinoma	Yes
20.	18	M	Mandible	Dentigeous cyst	Dentigeous cyst	Yes

Table 2- Showing statistical analysis of CBCT diagnosis comparison with histopathological diagnosis of the patients.

Comparison	Category	Total/20	Percentage
Sex	Male	11	55%
	Female	09	45%
Site	Maxilla	08	40%
	Mandible	12	60%
Accuracy	Yes	16	80%
	No	04	20%



Bar Graph 1- Showing statistical analysis of radiological diagnosis comparison with histopathological diagnosis of the patients.

Figure 1.

Figure 2.

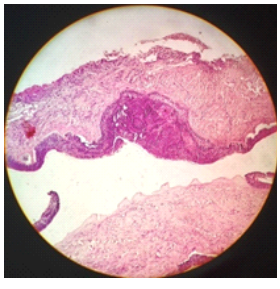


Figure 3.

DISCUSSION:

Reaching an accurate diagnosis is a fundamental step in the process of patient management and treatment planning.The process of reaching a correct diagnosis is not an easy one and proceeds through several stages that requires input from numerous outlets including clinical findings, imaging findings, and histopathology findings.[5]

The recent advancement in maxillofacial radiology aided in accurate preoperative assessment of the maxillofacial lesions and also assist in accurate diagnosis in treatment procedures. There are multiple intraoral and extra oral radiographic techniques such as periapical, occlusal, and panoramic views were available but these techniques have several limitations including two-dimensional image of three dimensional subject, insufficient visualization, superimposition, and distortion, which lead to underestimated assessment of the lesion. Recently the introduction of CBCT scan has a great role to solves the drawbacks of the old radiological methods. Cone beam computed tomography (CBCT), also known as digital volumetric tomography (DVT), volumetric computed tomography (VCT), or cone beam three-dimensional imaging (CB3D), is a relatively new technology in the field of oral and maxillofacial radiology.[4,5,6]

Cohen's kappa is the most commonly used measure to assess inter-rater reliability.[5] In our study Kappa was incalculable because the histopathologic diagnosis is the gold standard and therefore was constant. Instead of that we calculated percent agreement and we found 80% between radiographic interpretation and histopathologic diagnosis, which is similar than other published studies. A study by Sarabadani et al. in 2013 found the concordance between radiology and histopathology for central jaw lesions to be 71.4% , whereas the concordance between clinical impression and histopathology diagnosis was 80.4%.[5] Several studies have investigated the concordance between clinical and histopathology without any regard for imaging data.

CBCT uses a conical X-ray beam (in contrast to the fan beam of conventional CT) and a special detector that, depending on the technology developed by the manufacturers, may be an image intensifier tube or an amorphous silicon flat-panel detector. The X-ray source and reciprocal detector rotate synchronously around the head of the patient, in a single scan.

It revealed detailed information about lesions location, extension and relation to the adjacent vital structures, which aid the specialist in planning treatment in a less aggressive manner avoiding damage to vital structures with subsequent decrease of complications and in a relatively shorter time. Nakagawa et al. mentioned that accurate preoperative radiological examination of odontogenic lesions avoids surgical complications, and reduces surgical stress.[6]

CBCT offers an opportunity for a clinician to track growth change, appreciate borders in a depth perception that may otherwise be difficult to discern, and analyze relative approximation of adjacent vital structures. The advantages of CBCT in regard to evaluation and treatment pertaining to dentoalveolar surgery include increased visualization and exact location determination. Disadvantages of CBCT include cost and increased radiation exposure when compared to PANORAMIC radiograph.[7]

CBCT scan can give high diagnostic accuracy regarding lesions

extension, buccal and/or lingual expansion, resorption of the adjacent teeth roots and relation to the adjacent anatomic structures. This could be attributed to surgical factor including accidental removal of the thin bony spicules during preparation of the surgical access to the lesion or radioraphical factor including insufficient percentage of minerals loss to be appeared as a defect on the radiograph.[8] In the diagnostic process, histopathological analysis is considered to be the gold standard in determining the presence and nature of a disease.[3] (Figure 1 & 2. Showing Axial and Coronal CBCT view; Figure 3. Showing Histopathology picture of Unicystic Ameloblastoma).

In our study we compared the radiologic provisional diagnosis with histopathologic final diagnosis gives 80% accuracy rate in the correlation of the diagnosis. From these results, we found that, CBCT findings might predict histologic results more accurately. Also it has benefit to the patient including less time, cost, and radiation dose compared to more sophisticated CT scan imaging technique. It also guides the clinician during surgical procedure in a more predictable manner.

CONCLUSION:

CBCT now has become more widely accepted as a diagnostic technique for 3D imaging in jaw lesions as alternative to CT. Although soft tissue definition is limited due to poor contrast resolution which can be a limitation. CBCT can provide detailed information which can be use as described in the diagnosis, follow-up, and treatment of patients.

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